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THE
LARYNGOSCOPE.

VOL. LXI JANUARY, 1951. No. 1

THE EXPRESSION OF THE FACE AND MAN'S TYPE OF BODY AS INDICATORS OF HIS CHARACTER.*

HARRIS D. MOSHER, M.D.,
Marblehead, Mass.

The muscles of expression could perhaps be more properly called the muscles of emotion. As we all know, if we come down to breakfast with a smile or a frown, we can set the type of our emotions for the day or longer, and make or break the day as far as happiness and often as far as constructive accomplishment are concerned.

The face at first was a primitive affair. It was simply a trap for catching food and, from the first, was very efficient, especially when the lower jaw, which is the only movable part of the face, was added.

All animals except the very lowest have a face. In man, it is not always a success esthetically, being at times only a caricature of a face. No animal takes the liberties with his face that man does, especially the female of the species To

*This paper under the title "The Muscles of Expression," was used for years as the closing talk of my Post Graduate Courses, and so to the writer it has a certain sentimental value. It was given as a lantern slide talk which permitted it to be personal at times, and a bit of this atmosphere has been retained. From time to time the paper has been brought more nearly up to date.

All the illustrations are from lantern slides. The writer is embarrassed because he cannot readily find references for all the material which has been used. He hopes this may be pardoned, as the paper has no commercial value except for the engravers who have just turned the lantern slides into cuts for printing.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Oct. 30, 1950.

repeat, in all animals and in man the face is simply a food-trapping mask, but in man, with women, it is also a man-trapping mask.

The subjects dealt with in the paper are as follows:

The Evolution of the Face and Head. (Evolution as I have traced it in this paper, and briefly I hope, takes up the changes from ape, to half-man, and from prehistoric to modern man, during his millions of years of unconscious struggle to become one of us.)

Prehistoric Man as Found in Caves;

The Muscles of Expression;

The Face as an Indicator of Character;

The Type of Body as an Indicator of Character.

EVOLUTION.

Life first originated in water, probably because the rest of the earth had not cooled off enough. The first form of life, the amoeba, was hardly more than an animated globule of jelly. Food floated to it by chance and the amoeba's body floated around it, engulfed it, and assimilated it. The next animal instead of being all mouth developed a slit in the middle of one side of its body which acted as a definite mouth. Some say that originally there were two slit-like mouths. Had they persisted, what an unlovely picture today's dinner table would be. This first humble animal had neither nose nor eyes with which to detect its food, and no brain to figure out where food might be. These structures came next in order of development. The animal must have food or die. The same is true of us,—of us who are the summit of nature's achievement,—that is, some of us. The face, then, is built around the mouth, by the addition of the eyes and nose. The jaws which complete the face were added for the same reason as the nose and eyes, namely, in order to make the getting of food surer and easier. In order that the eyes should know what they

saw, the nose what it smelt, and that the jaws should shut at the proper time, a directing organ was necessary; hence, the development of the brain.

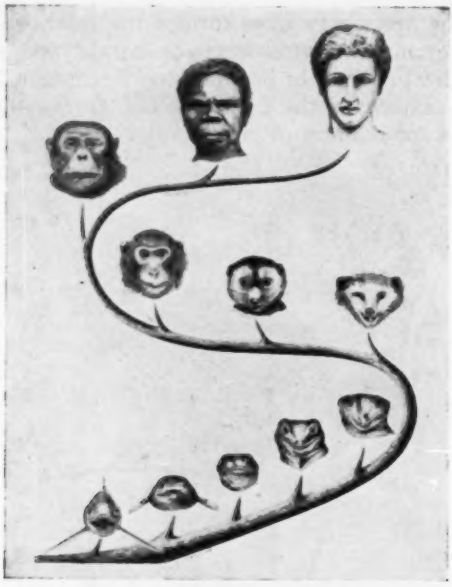


Fig. No. 1.
Our Face from Fish to Man.

1. Devonian shark.
2. Upper Devonian air-breathing, lobe finned fish.
3. Lower Carboniferous amphibian.
4. Permo Carboniferous reptile.
5. Triassic mammal-like reptile.
6. Cretaceous mammal.
7. Lemuroid primate.
8. Recent Old World monkey.
9. Chimpanzee.
10. Tasmanian.
11. Roman athlete.

The face of the Lemur 7 is the first to show a human likeness.

(From Our Face from Fish to Man—Gregory, Putnam's Sons, 1929.)

The first animals used their forelegs to kick their food into their mouths. These are called leg jaws. Man's jaws are not

developed from his legs but from the gill arches which the fetus of man at one stage of the embryo has in common with fishes.

When the first fishes were formed the seas swarmed with all kinds of invertebrates—sponges, corals, and crabs; and all the major problems of life, feeding, locomotion, and reproduction — sexual and the tamer asexual form — had already been solved for millions of years.

Fig. No. 2.
The Spectral Tarsier of Borneo.

This hideous little creature is supposed by some authors to be an early ancestor of the human race. It lived over fifty million years ago.

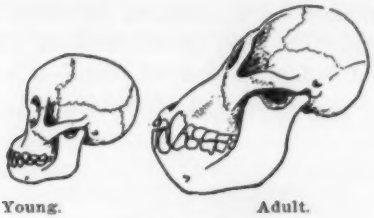
(After H. C. Raven.) (Reproduced from Gregory.)

It was literally a red letter day in evolution when an air-breathing lady-fish (probably a lung fish) didn't get home in time for lunch and laid her eggs on land instead of in the

water. This at once set the fashion for other lady fishes of her set and began the land development of vertebrates and soon—that is, in a few millions of years—it led to the next step upward—the development of reptiles.

Fig. No. 3.
One of Our Nearest Living Relatives.
Female Chimpanzee and Young.
(From "Almost Human," R. M. Yerkes, Century Co.)
(Reproduced from Gregory.)

At first the land was dominated by reptiles of enormous size and hideous form. Our direct ancestors were small apes who found trees the only safe place to live as the ground swarmed with monsters which, to them, were living mountains. Once up a tree, smell, which up to this time was the most useful sense, became less important as compared with sight. In order to live comfortably in trees, the apes, large and small, had to see where they were going. A jump in the dark, so to speak, could be fatal. Therefore, the eyes of these animals moved from the side of the head, where each eye saw separately, to the front of the skull where the eyes saw as one and gained the ability of measuring distance — stereoscopic vision.



Young. Adult.

Fig. No. 4.

Profiles of a young and an adult orang-outang showing that the young ape resembles the human more than when it is full grown. (After Wiedersheim.)

(From The Human Skeleton, Walter, Macmillan Co., 1925.)

As the animals increased in size, the long snouts were in the way in climbing, and the angle of the head on the spine was wrong. Accordingly, after a while,—that is, during the customary millions of years—the snout was eliminated, and the head was bent forward to bring the eyes into better position for climbing. By the time all this happened, the trees swarmed with apes and monkeys. Something then happened in the family life in the trees (probably a family row similar to those of today), and some of the apes took to the ground. Here they could stand up on their hind legs and soon learned to walk erect. They discovered that their forelegs were of more use as arms than as legs. Probably the first thing they did with their arms was to throw stones, and soon had the satisfaction of hitting an enemy from a distance and often avoiding hand to hand conflicts. This must have been one of the greatest joys that ever came into animal life at any period. Throwing stones remains a fundamental instinct of boy and man, even today. Further, instead of all the teeth being fitted for grasping and tearing, the back teeth became flat and were miniature millstones, for grinding. Up to the time of this change, all animals had lived by flesh alone. From now on, they could live on grasses and fruits. Some chose only this type of food, and do so to this day. Man is often said to be half savage. Certainly his teeth are: his front teeth still being used for tearing and biting, whereas his back teeth are used for grinding. It is thought that we come from

the non-fighting, peace-loving, plant-feeding ape. In this respect, man harks back to the slow-chewing cow-like type. Even today, there are many human cows.

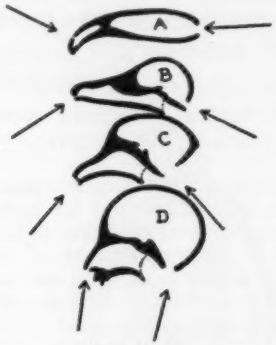


Fig. No. 5.

Sagittal sections through the skulls of a salamander (A), deer (B), baboon (C) and man (D).

The arrows indicate an evolutionary change in the relation of the snout and the nasal opening to the foramen magnum. (After Widersheim.)

The snout has gradually been eliminated. (From Walter.)

Fig. No. 6.

Head of a hippopotamus showing the projecting face. (After Hilzheimer.) (From Walter.)

Permit me, please, a word or two more to bring evolution up to date. At first, it was held that evolution advanced by constant small changes, but today the belief is that it advanced by jumps; sports, they are called in horticulture; in animals and man they are called mutations. The atomic physicists say that all energy including the energy back of evolution moves

in jerks like the hands of a watch. These jerks are now called waves. Thus, the quantum theory (quantum meaning a discrete bundle of energy) was developed and this theory plus the theory of relativity rules the world of physics today. As things are at present, it is easy to admit that this is a jerky world.

Still speaking of evolution, but not so technically, I should like to add the following condensed quotation from Jeans' "The Mysterious Universe" (page 26):

> Cosmic radiation from outer space falls on the earth in large quantities, and its power of destruction are immense. Every second it breaks up about twenty atoms in every cubic inch of our atmosphere, and millions of atoms in our bodies. It has been suggested that this radiation falling on germ plasm may produce the spasmodic biological variations (mutations) which the modern theory of evolution demands. It may have been cosmic radiation that turned monkeys into men." At Bikini all personnel were removed to six miles from the site of the bomb explosion, yet with many nurses their periods stopped for some months, and many men lost interest in their usual dates.

The following has been given as the future evolutionary changes due to come in man: As we are progressively losing our teeth, our faces are shriveling while our brains are growing larger and more powerful. Owing to our erect position, we are losing the lumbar curve of our backs, and the lumbar and sacral vertebrae as well as parts of the pelvis are becoming fused, which means that Caesarean section will, in time, become the normal method of childbirth. Language will be so developed and people will think such advanced thoughts that many will not be able to understand each other, and the weather then will not be the chief topic of conversation as it is today with most of us.

THE MISSING LINK.

Even before Darwin's day (1859—"The Origin of the Species"), there has been a vigorous hunt for the "missing link."

In 1824 (126 years ago) in South Africa, a short distance from the Kimberly diamond mines, the crucial parts of the prehistoric skeleton of a six-year old child were found. The parts were a skull and a number of teeth and they had enough human characteristics for this child to have the honor of being the nearest to the missing link yet found. It is called "Dart's Child," after its discoverer.

Fig. No. 7.
Hypothetical Sketch of "Dart's Child," the Southern Ape of South Africa.
(Source mislaid.)

THE SHARK'S FACE AND OURS.

The shark's face shows us our facial anatomy reduced to its lowest terms. We are nearer the shark than any other animal. The skull of the shark has the same twenty-eight bones that are in the skull of man. In the face of the shark, man can see his own face, as in a glass, darkly. Classes in biology the world over use a relative of the shark, the dogfish, as an epitome of the ground plan of human anatomy. This is taken as an insult by the fundamentalists, but such are the facts of comparative anatomy.

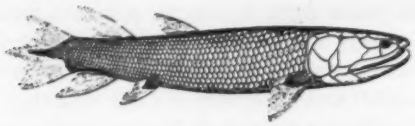


Fig. No. 8.

Devonian "Lobe-fin," first claimant in the line of the ancestry of the higher vertebrates.

(After Bryant.) (From Gregory.)

In certain fishes, the temporal muscle had so much work to do that it tore a hole in the side of the skull. This hole is filled up in the skull of a man, but a depression remains where the hole used to be. This is the temporal fossa and is one of the most conspicuous markings on our skulls.

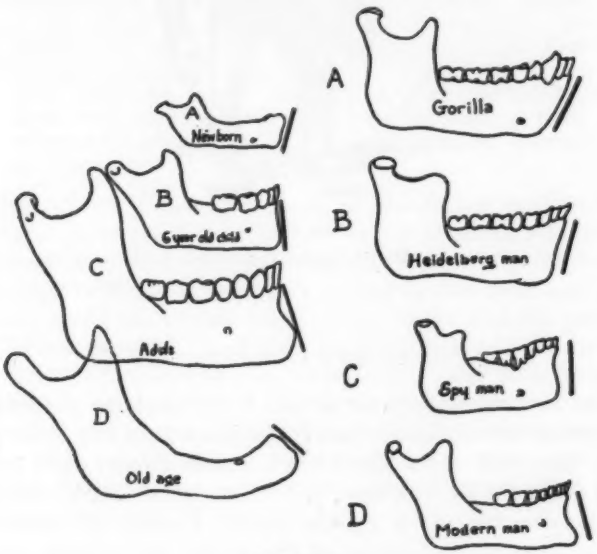


Fig. No. 9.

Changes in the chin-angle during the life of the individual.

Changes in the chin-angle during the history of the race. Man is the only animal who has a projecting angle of the chin.

(From Walter.)

There was another early change in the form of the skull and, so, of the face. From the rim of the orbit, posteriorly and inferiorly, a bridge of bone was developed. This bridge, the zygoma, ran backward horizontally from the angle of the orbit and from the cheek bone (malar) to join the skull in front of the ear, and ended by making the anterior part of the joint of the jaw. On its way back, it is fully an inch from the side of the skull; that is, the temporal fossa is that deep where the tendon of the temporal muscle runs inside it to be attached to the lower jaw. Without the bridge, there would be a tremendous hollow behind the eye on the side of the head, and every time we closed our jaws the temporal muscles would bulge out like a second pair of ears.

SCIENTIFIC DETECTIVE WORK.

The molar teeth and bits of the lower jaw have given the best clues of the progressive change-over from ape to man. A bit of lower jaw with three teeth gave anthropologists the first clue to the changes. As apes are often larger than men, their heads and teeth, especially their molars, are larger. The cusps of the molars have a regular order and change in a regular manner as man is approached (see Gregory, p. 151).

The plotting of the changes in prehistoric teeth is one of the best pieces of detective work that science has ever done. It was a planned affair, not an accidental discovery like penicillin.

Fig. No. 10.

Artificial Deformities of the Skull.

Fig. A. Occipital deformity of the skull due to cradle-board. Southwest U. S. Indian.

Fig. B. Fronto-occipital flattening of the skull. Northwest coast Indian.

Fig. C. Conical deformity due to bandages. Peruvian Indian.

(Am. Museum of Nat. Hist.)

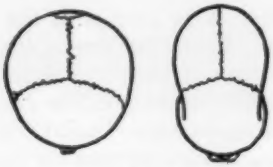


Fig. No. 11.

Extreme brachycephalic (Tartar) and dolichocephalic (New Zealander) skulls.

(After Huxley.) (From Walter.)

The above are the common types of head, the broad head and the narrow high head.

THE CAVE MAN.

One of the first caves in which remains of prehistoric man were found was in Wales. The findings were kept secret for ten years because they cast doubt on the Bible stories of the origin of men. To doubt the Bible meant social ostracism, or even worse. The same was true in parts of this country not many years ago.

The caves are the history books of prehistoric man. They show how he gradually lost his ape-like characteristics and they give the type of utensils and weapons he invented and used. As time went on, the wall drawings and paintings indicate the degree of civilization which the dwellers in the caves gradually attained. For accuracy they put to shame modern, so-called art, and DuPont has never equalled the lasting qualities of their pigments now brilliant centuries after they were first applied.

The explorer's instinct often makes him do things which to the rest of us are foolhardy in the extreme. For instance, a French boy found a hole on the side of a hill and crawled into it. The story did not say that he had any light, certainly not a flash-light, and he surely did not know where he was going, but his adventure ended by discovering one of the largest of the cave dwellings yet found and one showing the nearest to civilization as we know it. In fact, the man who lived in this cave knew how to sharpen flint to a razor edge.

Fig. No. 12.
Woolly Rhinoceros.

THE APE CHARACTERISTICS.

The ape has no chin, a flat forehead, a horizontal ridge of bone over the eyes, and a sagittal crest along the middle line of the top of the skull. The hard palate is wider in front, rather than behind. The mental tubercles for the attachment of the tongue muscles of man are replaced by a fossa. Both the lower jaw and the teeth of the ape are much larger than in man.

In connection with the wanderings of the tribes of prehistoric ape-like men, one has to remember that there were three ice ages, each with an interglacial period when the climate was livable for the ape-like men. They roamed and hunted in the valleys, and on the plains. They skirted the edges of the glaciers, and the Arctic animals came down near enough to be hunted. These included the mammoth, the woolly rhinoceros, and the equally well protected elephant. When the inter-glacial period ended and the ice moved south again (even, at one time, covering all of France), the ape-men took to the caves against the cold. The fossil bones and the stone implements and bone ornaments date the periods of the different races of prehistoric man. As stated above, the first caves to be explored were in Wales; then a few were found in France, and finally, they were found all over that country. A cave forty miles from Pekin, and one of the richest, was half explored when the Second World War stopped the work. Next to caves, limestone deposits which are being worked today for commercial purposes have yielded a wealth of bones of prehistoric animals

and prehistoric man. These were regularly burned for lime and many a precious specimen linking apes and man has been lost. One cave which was used as a sepulcher was panelled with the shoulder blades of a mammoth, and the femurs of this animal were piled up as we stack cord wood, and ash heaps showed they were burned as wood, on account of the large amount of fat in the marrow.

Fig. No. 13.
Neanderthal Man.

There were a number of "Gardens of Eden"; that is, caves of ape-like men have been found in India, Java, China, Central Asia and Africa. There were, therefore, an equal number of Adams and Eves.

In the very early days of the earth, Ireland and England were one, at least geographically, and were joined to the continent of Europe. Africa also was joined to Europe by Gibraltar, Italy, Sicily and Malta. Alaska was a part of Siberia. The prehistoric tribes, therefore, could, and did, travel all over the earth by land, even reaching North and South America. Animals which we know today only in the tropics, like the elephant, the two-horned rhinoceros and the lion, got as far as southern Siberia. Both ape-like man and animals anticipated Horace Greely's advice, and went West.

THE ERECT APE MAN OF JAVA.

Tribes of Forest Apes (our first ape ancestors) roamed over France, Spain, Africa, and South Eastern Asia. One of these, the Erect Ape Man of Java, is called the first human being. He had a big brain, 1550 cc. This is 200 cc. larger than the average human brain, which measures 1350 cc. This ape walked erect, could talk, knew fire, and made crude stone implements. He and his race were giants; as to his intelligence, he would be rated today, probably, as a sub moron.

THE PEKIN MAN.

The Pekin Man is called the first cousin of the Java Ape Man. He was found in a cave forty miles above Pekin, China. Placed next in line of success is the Heidleberg Man, whose period is given as the Second Ice Age.

Fig. No. 14.

Neanderthal Man (left) and Cro-Magnon Man.

The Cro-Magnon man is rated as the most perfect physical type of man that ever existed.

THE NEANDERTHAL MAN.

The period of the Neanderthal man is also the second ice age, and he lived in Southern Germany. This was a large tribe which populated western Europe for many thousands of years. Many of his caves have been found. He buried his dead, and seems to have believed in life after death. He used fire and invented pressure chipping. This was a method of

making stone knives with edges as sharp as our modern razors. This invention is ranked as of equal importance with the discovery of the crucible for melting iron. The Neanderthal Man disappeared 25,000 to 30,000 years ago.

THE CRO-MAGNON MAN.

The Cro-Magnon man was named from the French town where he was first found. His tribe spread widely over western Europe and became the predominant race, and our nearest ancestor. These men were the finest, physically, the world has

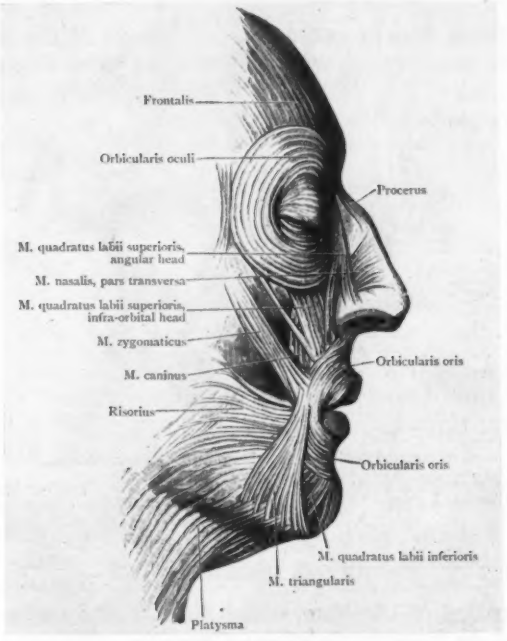


Fig. No. 15.

In this cut the Zygomaticus Minor muscle is made a part of the Quadrate muscle of the upper lip, and is not given a separate label. It lies to the nasal side of the Zygomaticus Major. In this article the writer considers the Zygomaticus Minor a separate muscle, and a companion muscle to the Zygomaticus Major.

(From Cunningham.)

ever known. They were six feet tall and had big brains. They were all said to be handsome, as we, their descendants all are not, and their cave drawings and paintings were the beginning of modern art, and much better than some of it, and they started the first basic elements of civilization.

THE MUSCLES OF EXPRESSION.

When we examine the face of man, we find that it is composed chiefly of holes,—the nose,—the orbits,—the mouth. These are more or less visible. Five invisible cavities,—the antra and the frontal sinuses and the ethmoidal cells,—complete the hollow shell which makes the upper part of the face. The lower jaw is the only solid and movable part. The orbit is 50 per cent larger than the antrum. The length of the orbital fissure is twice the length of the opening into the nose. The size of the mouth defies comparison.

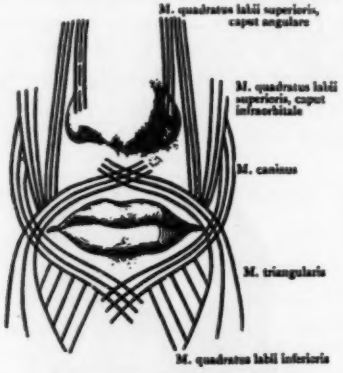


Diagram of the Orbicularis Oris Muscle.
The fibres which enter it from the buccinator are not represented.

Fig. No. 16.

(From Cunningham.)

The muscles of the face are divided into two groups; the superficial muscles, which are attached to the skin and are called the muscles of expression, and a deep set attached to

the jaw, the muscles of mastication. The face owes its great power of expression to the large number of muscles which can change the contour of the skin of the face, and to their large nerve supply. Although small, the muscles of expression are among the strongest muscles of the body. The facial nerve dedicates itself to the movements of these muscles.

There are thirteen muscles of the face which are classed as muscles of expression. Most of them are superficial and all of them are paired except two,—the circular muscle of the eyelids, and the circular muscle of the lips. There are three muscles of the nose; adding these, the total number of muscles of expression is sixteen.

Another system of skin muscles is originally located in the neck region in reptiles and birds, but extends over a greater part of the face in mammals. It is innervated by the facial. In turtles and birds it encircles the neck with its transverse fibres and gets the name of the sphincter colli. In mammals it divides into two sheets,—a more extensive superficial layer, the platysma, and a smaller layer still called the sphincter colli. The fibres of the two muscles run primarily at right angles to each other, the platysma running obliquely upward and the sphincter colli across and round the neck.

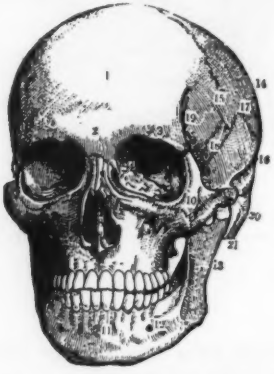


Fig. No. 17.
Front View of Skull.

In following the phylogenetic series up to primates and man, a considerable extension of these two layers over the head and face is noticed, and as they meet the eyes, nose, and ear and lips, they give off slips for the regulation of these parts.

THE MUSCLES OF EXPRESSION.

The names of the muscles of expression are so aptly descriptive that simply giving their names, stating a little about their origins and insertions, and reproducing a few anatomical plates so that the muscles can be visualized, the writer considers sufficient for the purposes of this paper.

The muscles of expression bring about the changes of the face which characterize the various emotions, by acting on the forehead, the eyebrows, the corners of the eyes, the corners of the mouth, and the furrow from the side of the nose to the upper lip, known as the naso-labial line.

A sphincter muscle closes both the eyelids and the lips. All the lip muscles take part in the sphincter. The sphincter of the eyelids is divided into two parts, the upper part serving the eyebrow, the lower part the lids.

THE ORBICULARIS PALPEBRARUM.

This is the sphincter muscle of the eyelids. It is divided into two parts. The upper and stronger part lies on the upper margin of the orbit. It extends upward and interlaces with the frontal division of the occipito-frontalis muscle, and mixes also with the corrugator supercilii—a small horizontal muscle just above the eyebrow which, with its mate of the opposite side, makes the two vertical ridges between the eyebrows.

THE ORBICULARIS ORIS.

This is the sphincter of the lips. The greater part is a continuation of the buccinator forward and around both lips; all the muscles of the lips contribute to it.

THE LEVATOR OF THE UPPER LIP AND THE WING OF THE NOSE.

This small muscle has the longest name of all the muscles of the body. It rises from the upper part of the ascending process of the superior maxilla. As it runs downward it divides into two slips, the upper one going to the wing of the nose, while the lower one continues to the upper lip. It is in close relation to the naso-labial fold, and so plays a significant rôle in certain expressions of the face.

THE ZYGOMATICUS MAJOR.

This muscle springs from the malar bone in front of the zygomatic suture. It runs to the corner of the mouth, attaches to the skin, and blends with the sphincter of the lips and the depressor of the angle of the mouth.

THE ZYGOMATICUS MINOR.

This slender but sturdy muscle starts from the malar bone in front of the zygomaticus major and runs to the upper lip. It influences the shape of the naso-labial fold. Modern anatomical nomenclature joins it to the outer part of the levator of the upper lip, and it reaches the upper lip through this. It loses its old name of zygomaticus minor.

THE LEVATOR OF THE UPPER LIP.

This is a flat band of muscle which rises from the lower rim of the orbit and runs to the upper lip.

THE LEVATOR OF THE ANGLE OF THE MOUTH.

This muscle springs from the upper part of the canine fossa of the superior maxilla just below the infra orbital foramen, runs to the angle of the mouth and continues on to the lower lip thus surrounding the angle of the mouth. By contracting it raises the angle of the mouth.

THE DEPRESSOR OF THE LOWER LIP.

This is a strong, quadrate muscle which has a linear origin from the lower edge of the lower jaw starting from the symphysis and ending a little beyond the mental foramen.

THE DEPRESSOR OF THE ANGLE OF THE MOUTH.

This is a flat triangular muscle which rises from the external oblique line of the lower jaw anteriorly. It runs upward to the angle of the mouth and above and around it into the upper lip. It depresses the angle of the mouth.

The muscles of expression are ideally simple, and splendidly efficient. They come from where you would expect, and are aptly named. Two chief muscles are sufficient to control the lower lip, but nature found it harder to control the upper lip and had to devote five muscles to it. It is easier to close the eyes than the mouth. I omit a too obvious comment on this.

THE MUSCLES OF THE NOSE.

The compressor of the nose springs from the superior maxilla close to the bony rim of the anterior nasal opening. The muscle and its mate from the other side join by a medial aponeurosis and cover between them the cartilaginous portion of the nose.

THE LEVATOR OF THE UPPER LIP AND THE WING OF THE NOSE.

This muscle has been described before. It is mentioned again because the upper slip of the muscle goes to the wing of the nose, and so makes it a muscle of both the nose and the upper lip.

THE PYRAMIDALIS.

This muscle springs from the aponeurosis of the compressor of the nose. It runs upward on the nasal bone, some of its fibres reaching the skin of the lower forehead, while others join the frontalis muscle. Through its pull on the compressor

of the nose by its origin from the aponeurosis of this muscle it probably has some control of the naso-labial fold; it influences the shape of the eyebrow and the lower part of the forehead.

THE DEPRESSOR OF THE SEPTUM OF THE NOSE.

This muscle springs from the incisor fossa of the superior maxilla. Its outer margin blends with the compressor of the nose. It arches upward and forward and attaches to the lower and back part of both the wing and the septum of the nose.

THE DILATOR MUSCLE OF THE NOSE.

This muscle is composed of two slips. They rise in the dense tissue at the lower and outer part of the nose above the nasal opening. The anterior slip is placed on the lower part of the side of the nose near the tip. The posterior slip lies just behind.

The muscles just described open and narrow the nostrils. The nostrils open wider in sniffing and in deep breathing through the nose. In man and animals the nostrils dilate in sexual excitement. A familiar example is the tossed up head and the quivering and dilated nostrils of the expectant stallion.

In the description of the muscles of expression, especially with the names, the write has mixed up Latin and English. This was done hoping to make the anatomy less formidable.

THE FACE AS AN INDICATOR OF CHARACTER.

Ever since Adam took his first long, loving look at Eve, the face has been considered an expression of character. Roughly this is true, but we are constantly getting fooled. Eve, the apple and the snake fooled Adam. Cain killed Abel, and Cain must have looked like his father, his mother, or God, his only three ancestors,—and they probably had attractive faces. The chain stores won't trust any man's face, although someone has to trust them. Nevertheless, the face, as I have just said,

is roughly an expression of character. We have the stolid face of the Indian, the poker face of the gambler, and the kindly face of the motherly old lady or the motherly old man. Of course, too, we have the face of the modern young lady, but this is seldom her own, — and the only safe judgment which can be made about it is that it is often distractingly pretty and fatally alluring.

Speaking of telling a person's character by his face, giving a post graduate course often is no mean way.

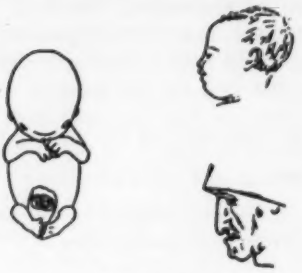
The muscles of the face in expressing emotion act upon the eyelids and lips, but chiefly on the corners of the eyes, and the corners of the mouth; also, they act upon the naso-labial line, the furrow which runs from the side of the nose to the upper lip. These parts (Bell) have the least expression in animals, for they have no eyebrows and no power of elevating or depressing the angle of the mouth.

The most remarkable muscle of the human face, according to Bell, is the corrugator supercilii. It knits the eyebrows and gives the idea of mind behind the face. The next most expressive muscle is the depressor of the angle of the mouth. It is peculiar to mankind and expresses the emotions of contempt disgust and hatred.

In carnivora, the facial muscles run to the angle of the mouth. In herbivora, they run to the lips so that they can be pulled away from the teeth in grazing.

Writings on the subject of the face as an index of character began at least four hundred years ago. To us, fancy, if not foolishness, predominates in them, and they contain many loose observations posing as philosophy.

For the last hundred years, and today, the investigations concerned with this subject have been thoroughly scientific. Darwin wrote on the "Expression of the Emotions in Man and Animals," and the English physiologist, Sir Charles Bell (1844), celebrated for his studies of nervous system, and whom I have just quoted, also analyzed the expressions of the face.



A human embryo at eight and one-half weeks, showing relatively large size of the head. (After Kollmann.)

The profile of infancy, and the profile of old age.

(After Sir Chas. Bell.)

Fig. No. 18.

The Anatomy and Philosophy of Expression. Sir Charles Bell—Fifth Ed. Bohn, London, 1865, p. 45.

EARLY WRITERS.

Astrology. CARDAN. *1501-1576* (448 years ago).

According to the books, geniuses are often illegitimate. The Italian Cardan was in this class, and was the earliest writer on the face as an indicator of a person's character that I have noted. Over four hundred years ago he wrote a book on this subject. In the variety of his attainments, he rivaled Leonardo da Vinci.

As an astrologist, he believed that the stars determine a man's character. When you consider what the cosmic rays are continually doing to us, he may have been a bit on the right track. He held that man's character was shown in his face, especially by the furrows of the brow. In the book which he published, there are illustrations of 700 variations of possible lines on the forehead, each one having a special meaning. To the writer this seems crazy.

Of the other early writers, LeBrun wrote on the resemblance of certain types of the human face to the heads and faces of animals.

Levater wrote a book entitled "The Art of Knowing Man by His Countenance." In it, he gets off on chapters devoted to imaginations, and envies,—warts and beards,—and to lines of animality.

Fig. No. 19.

Le Brun gives many plates showing the resemblance of many human faces to the faces of animals. Two of his cuts are shown here. He was especially interested in the relations of the countenance to character.

Sue, in Paris, in 1797 (only 153 years ago), is maudlin in his sentimental approach to the study of physiognomy. For instance, he says: "A mouth delicate and pure is, perhaps, one of the best recommendations." He stops at nothing, and speaks dogmatically of the physiognomy of fishes, serpents, grasshoppers, and intestinal worms. "Intestinal worms have a very decided physiognomy, the character of which inspires in man sorrow and awe." For once, I might agree with him.

From now on, what I have to say, with one exception, is scientific and makes present day sense.

CAMPER. *1722-1789.*

Camper was the first to chart the facial angle. He analyzed the action of the facial muscles, and laid down the general rule that the contraction of each muscle of the face produced in the skin one or more folds, the direction of which is perpendicular to that of the muscle. This is true of almost every muscle of the face. The frontal is the most striking example.

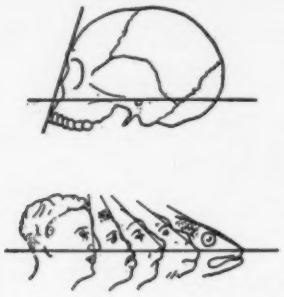


Fig. No. 20.

Upper figure. A profile of a skull showing Camper's angle.
(After Topinard.)

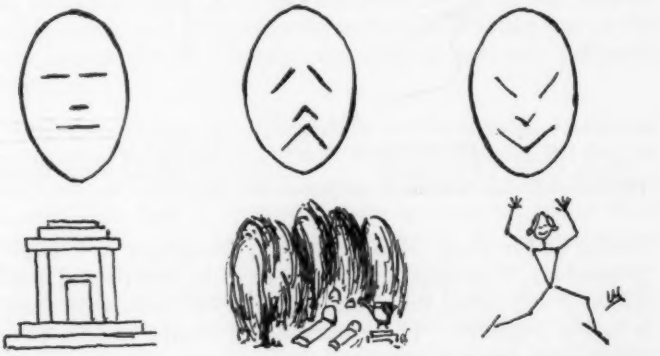
Lower figure. The evolution of the facial angle.
(After Witkowski.) (From Walter.)

SUPERVILLE.

In 1827 (123 years ago), Humbert de Superville published a book entitled, "Des Signes Inconscients de l'Art," which, as best I can translate it, means: "The Unconscious Suggestions of Art." The author gives three drawings of the human face, in which the lines represent the eyes, the lower boundary of the nose, and the lips. In the first drawing, the lines are all horizontal; in the second, they are all inclined downwards and outwards from the median line, and, in the third, all the lines are inclined upwards and outwards. The author states that the first figure (with the lines horizontal) produces an impression of calmness, greatness, and constancy; and he adds that, likewise, in nature and architecture, horizontal lines give rise to the idea of calmness, stability, and grandeur; the

cedar, with its horizontal branches, is of all the trees the one that gives this impression in the highest degree. The second figure (with the lines oblique downwards) gives an impression of sadness, pain and grief; and the writer compares the direction of the features of such a countenance with the direction of the architectural lines in tombs and funeral monuments, and to branches of the trees which everywhere are planted, in preference to others, in cemeteries (weeping willows), and whose branches always hang obliquely. Lastly, the third figure (with the lines obliquely upwards) gives rise to the impression of gaiety, levity, inconstancy; and to continue the preceding comparisons, Chinese architecture with its lines oblique and diverging upwards and outwards, can never, at least in the eyes of a European, produce an impression of greatness and majesty.

All the muscles which take part in the expression of pain sadness and contempt help to incline the features obliquely downwards and outwards, some by acting on the line of the eyes, others on that of the mouth.



1. Calmness. 2. Sadness. 3. Gaiety—Inconstancy.

Fig. No. 21.

This is a rough blackboard drawing by the writer of de Superville's three fundamental expressions of the face.

Having been with the men of my Post Graduate Course for seven weeks, it was easy in this closing lecture to attach appropriate names from the members of the class to each of these figures. These always brought down the house, so to speak, and probaly were the best remembered part of the talk. (From Artistic Anatomy, Duval, pp. 284-285-286.)

I said, further back that, with one exception the rest of the paper would be purely scientific according to modern standards. Here is the exception.

PHRENOLOGY.

One of the comparatively modern ways of telling the character of a person is to chart the skull, assigning the various attributes of the mind, body and soul to special bony beds or

Fig. No. 22.

The Phrenological Chart of the Skull.

Notice figures 1-2-3-4 and 6. (After Fowlers and Wells, Practical Phrenologists and Publishers, 131 Nassau St., N.Y.)

bumps on the skull. Man's character, according to the cult of phrenology, is summarized on his skull by bumps and depressions. I will agree that bumps have a lot to do with making a man's character. These bumps, the bumps of life, though often hard are not bony.

In many cities on the harbor excursion boats phrenologists frequently plied their trade. A passenger paid twenty-five cents to have his head examined and his bumps evaluated. The chart which was given him was always flattering, and it was carried home for the family archives.

The writer was interested to see that, as in the illustration, on the back of the head where amativness is located, Cupid, the marriage ceremony are shown, and two boys in a fist fight. Belligerency comes next to love.

DUCHENNE. *1806-1874.* (144 years ago.)

Darwin wrote "The Origin of the Species" in 1859. Later (1874) he wrote a paper on "The Expression of the Emotions in Man and in Animals." The illustrations of Darwin's paper were mostly reproductions of photographs published by Duchenne ten years before. These had lain neglected until Darwin made use of them. Then due credit was given to Duchenne as the one who had introduced the experimental study of physiognomy.

In 1874, in the course of anatomy in the School of Fine Arts, Paris, the French began to devote several lectures on what must be called the primer or grammar of physiognomy. Happy in seeing his works included in this classical course of instruction, Duchenne, who died a short time later, gave to the School of Fine Arts the complete series of his original photographs, and this beautiful collection is today one of the most valuable in the French museum of anatomy (Museum Hugnier).

Duchenne began his experiments on the head of a criminal executed by the guillotine. He exposed a muscle of the face by dissection so that he could excite it singly by the galvanic current. He had to work fast because muscles retain their excitability for only two hours after death. He photographed the facial expression produced by the contraction of the muscle. Soon he had the good fortune to find an almshouse inmate whose face, from a nerve ailment, was insensitive to pain. His experiments on this man gave the brilliant photographs which Darwin borrowed.

In order to understand the mechanism of the frontal muscle, it is necessary to consider it as taking its fixed insertion at the posterior part of the skull, by the epicranial aponeurosis and the occipital muscle; its free insertion is in the deep

CONTRACTION OF THE FRONTAL MUSCLES
(expressions of *attention* and *astonishment*.)

Diagram of the *frontal muscles* (*attention*).

Fig. No. 23.

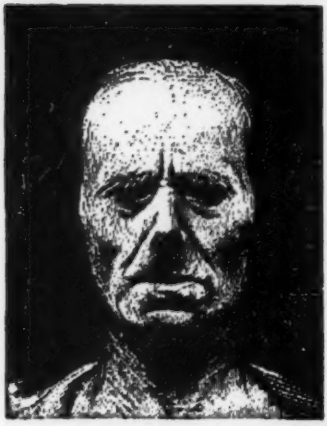
The Muscles of Expression from the Atlas of Duchenne. Artistic Anatomy—Duval, Cassell and Co., London, 1898.

(This plate and the five companion plates which follow are all from Duval.)

surface of the skin of the eyebrow. The frontal, therefore, in contracting, draws this skin from below upwards, and consequently raises the eyebrow, and causes the transverse folds to appear in the skin of the forehead.

In examining a face in which this muscle is contracted, we perceive that it expresses attention; if the contraction of the muscle is very great, this expression of attention changes to that of astonishment.

The superior orbital orbicular muscle (muscle of reflection) is placed beneath the skin of the eyebrow, and its fibres describe an arc with the concavity downwards, of which each extremity is adherent to the corresponding part (internal or external border) of the orbital opening.



THE UPPER PART OF THE ORBICULARIS PALPEBRARUM (*reflection*).

Diagram representation of *reflection, meditation.*

Fig. No. 24.

Figure 24 is the representation of reflection, characterized by the absence of the frontal folds, the depression of the eyebrows and the presence of two small vertical folds in the space between the eyebrows, to which the depression of the eyelid gives rise. This representation of reflection does not acquire its full significance until we compare it with that of attention.

Superciliary muscle (or muscle of pain).—This short muscle is deeply hidden beneath the skin of the region of the head of the eyebrow. Its fixed insertion is into the frontal bone, above the superciliary arch. From this origin, its fibres are directed outwards and slightly downwards to be inserted into the deep surface of the skin at the middle of the eyebrow.

The great zygomatic muscle (or muscle of laughter).—This muscle, called also the external oblique elevator of the commissure of the lips, has its fixed attachment on the cheek

Diagram representation of *sorrow*.

SUPERCILIARY MUSCLE (*sorrow*).

Fig. No. 25.

bone; from this origin it is directed obliquely downwards and inwards to be inserted into the deep surface of the skin of the commissure of the lips.

The triangular muscle of the lips (muscle of contempt).— This muscle depresses the labial commissure and, therefore, renders the line of the lips obliquely downwards and outwards. Again, it draws downwards the inferior extremity of the naso-labial furrow so as to render this furrow almost straight.

The expression produced by this change, if it is slightly marked, is that of sadness; if it is very much so, that of contempt. The partial closing of the eyelids usually helps to complete the expression of contempt.

The square muscle of the lower lip (muscle of disgust).— This muscle, partly hidden by the base of the preceding, arises like it, from the anterior part of the horizontal branch of the

A. B.

Fig. No. 26.

Fig. A. The external common elevator of the lip is another name for the Zygomaticus Minor muscle (muscle of grief).

Fig. B. The internal common elevator of the upper lip is another name for the Elevator of the Upper Lip. This is the muscle of grief and tears. It raises the upper lip but not the angle of the lip. It raises the center of the naso-labial fold. Its action is the reverse of the Zygomaticus Major, the muscle of laughter.

(After Duchenne.)

inferior maxillary; from this origin the fibres ascend obliquely upwards and inwards to be inserted into the whole length of the lower lip.

Platysma Muscle of the Neck.—On each lateral half of the anterior surface of the skin is extended a thin muscular sheet lining the skin. The platysma is attached below to the upper part of the chest, from which origin its fibres are directed obliquely upwards and forwards towards the lower jaw, to be inserted into the skin of the chin, of the lower lip, to the commissure of the lips and to the cheek. The more superior fibres are almost horizontal, extending from the skin of the region of the ear towards that of the labial commissure; to these superior fibres we sometimes give the name, but little justified, of the risorius of Santorini.

GREAT ZYGOMATIC MUSCLE (expression of *gaiety* and *laughter*).

Fig. No. 27.

Diagram representation of *laughter.*

TRIANGULAR MUSCLE OF THE LIPS (expression of *discontent*, of *contempt*).

Fig. No. 28.

Diagram representation of the expression of *discontent*, of *contempt.*

The platysma, which is not expressive by itself, adds its contraction to that of various muscles of the face, so as to give to the corresponding expression a character of terrible energy; the risorius of Santorini does not, therefore, produce the expression of laughter (of gaiety), but only that of grinning, of forced laughter, threatening, or sneering. The platysma, in all these cases, acts by depressing the lower jaw, slightly opening the mouth, and drawing the labial commissure downwards; at the same time, it marks a series of transverse folds on the skin of the neck. These elements are capable of giving to the face an expression of terror, which Leonardo da Vinci has well observed when, in his chapter on the mode of representing a person in a state of violent anger, he says: "Make the sides of the mouth in a bow, the neck thick and swollen, and marked with wrinkles in front."

We have just seen how the muscles of the face show the different emotions and, so, how an habitual facial expression can be an indication of a person's character. Modern investigators hold that the body type of a man also is an indication of his character. Some of their deductions seem at first a bit fantastic and make one think a little of the early writings of two hundred years ago.

Keith, Stockard, Davenport and Bolk are slowly bringing modern physiognomy toward the goal of the ancient writers, namely, the correlation between facial and bodily characteristics and character. What I have to say from now on is taken from Stockard. He was thoroughly scientific as far as growth is concerned. He did much work on the human fetus.

GROWTH OF THE BODY.

Two glands with their hormones, the hypophysis and the thyroid, control growth. The way they function determines whether we are skinny or fat. Jack Spratt and his wife owe their bodily differences to the different functioning of these two glands.

The normal amount of secretion from the hypophysis produces longer bones and a taller individual. When the secretion is sufficiently below normal, dwarfism is caused. Normal growth has to occur before the epiphyses close. Giving anterior pituitary extract has been known to cause five and a half inches of growth in twelve months.

VARIATIONS IN GROWTH.

The bull dog and a certain type of human dwarf with a broad face and a turned up nose owe their peculiar features to a derangement of the hypophysis. The base of the skull ceases to grow and becomes ossified. The upper jaw fails to grow. The head grows to the side, the nose fails to grow but the lower jaw, not being a part of the skull, grows out of proportion. The opposite condition and the stimulation of growth are also due to a disturbance of the pituitary. It is characterized by an excessive growth of bone in the linear direction. This is called acromegaly. The face is long. Giants are of this type. Among dogs, the St. Bernard and the mastiff show acromegaly with giantism. The blood hound shows acromegaly without giantism. His facial expression closely resembles the human acromegalic.

The opposite condition to giantism is responsible for true midgets. Midgets grow normally up to five or six years and then stop growing. They may or may not become sexually mature and often have infantile faces. Among dogs, the King Charles Spaniel, in shape, outline and expression is almost a picture of the human midget.

STOCKARD'S CLASSIFICATION.

Stockard recently classified the human face and the body into two types, the linear and the lateral. In the linear type, owing to a high rate of metabolism, — caused by a highly active thyroid gland, growth along the long axis of the body—from the tip of the nose down and back—greatly predomi-

nates over growth in the transverse plane. The linear type is the faster growing, the body is thin but not necessarily tall. The lateral type, owing to the low thyroid activity, is slow in maturing and the body is stocky and rounder in form; that is, the transverse growth components are relatively greater than in the linear type. Stockard's recognition of these two types was the result of long experimental work on the factors of growth during the embryonic development of animals.

The lateral type arrives at puberty a little late and is slow in differentiating. The larynx does not develop so suddenly, and is not so large. The voice is a tenor, not a bass. The fine tenor is a fat man (tenors, please stand), while the heavy bass is tall and thin (basses, please stand).

Stockard gives the character of each type, as follows; reading a person's character from his figure and face.

The lateral type is careful and painstaking and doesn't draw conclusions until a mass of detail has been accumulated. He is emotional and is easily moved to tears.

The linear type is tall and thin. He has difficulty in accumulating detail and in working a subject out thoroughly. He draws conclusions hurriedly. He is not emotional and is ashamed to cry. He has great self-control, and among savages the chief is always of this type. Among civilized people, the lateral type are often rulers of great ability. The lateral type are popular but do not see the great principles of the future. Presidents of the linear type are honored long after their terms of service, but are not popular during their terms of office. The lateral type of presidents are the idols of their time, but leave nothing to be remembered by.

CONCLUSION.

There is much justification, as I hope you have just seen, for the century-old belief that you can tell a man's character from his face. Intuition, however, or as Andy calls it, "a

woman's ignition," is still a good guide in spite of all that science has learned and explained. Character shows so plainly in the face because the muscles of expression make the face wonderfully responsive to the emotions,—good and bad.

One more word, in closing. In case you did not notice it, I wish to remind you that in the face, the muscles of joy and sorrow lie side by side. In life, joy and sorrow are side by side. Nature knew what was coming to us, because she provided only two muscles for joy — but four for sorrow. If you are an optimist, put this in your pipe and smoke it.

127 Front Street.

THE USE OF CURARE* DRUGS IN ENDOSCOPY.†

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The introduction of curare-like drugs into clinical medicine as muscle relaxing agents has been of benefit to the patient, anesthesiologist and endoscopist. More information on indications and contraindications for their use as well as on techniques of administration is necessitated by an increased demand for these drugs for laryngoscopic, bronchoscopic and esophagoscopic procedures. The need for a proper, safe technique of administration has become apparent as more physicians use these drugs for such procedures. Many advantages and disadvantages present themselves in the use of curare. This paper is written in an effort to clarify the position of relaxing agents in the armamentarium of the endoscopist.

HISTORY.

"Curare" is the generic term applied to South American Indian arrow poisons. It was first brought to England in 1595 by Sir Walter Raleigh, and soon many stories were told of its paralyzing action and fatal consequences in animal and man. Then, except for the work of Charles Waterton (1812), who demonstrated that asphyxia is the cause of death by the drug, and Claude Bernard (1844), whose classical experiments showed the action of the drug to be on the neuromuscu-

*The word "curare" will be used in this article in its generic sense to imply all of the natural and synthetic preparations having a pharmacologic action similar to d-tubocurarine chloride, which is the active alkaloid of crude curare.

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lar junction, curare fell into clinical obscurity. It became a toy for the physiologist and pharmacologist to demonstrate myoneural blocking action.

The successful introduction of curare into therapy began with Intocostrin, a preparation standardized by biological assay from an extract of chondrodendron tomentosum. Following the first reports of its effects in electric shock therapy[1] other indications for its use became recognized. Mixtures of curare alkaloids as present in the original preparation (Intocostrin) have been largely replaced by a single alkaloid, d-tubocurine chloride, isolated from the crude curare.[2] As a result, this drug is now widely used as an adjuvant in shock therapy, anesthesiology, endoscopy, tetanus, rigidity, spasticity and hypertonicity.

PHARMACOLOGY.

The classical work of Claude Bernard has established that curare acts on the myoneural junctions by preventing nerve impulses from reaching the effector muscle cells. The action is due to the elevation of the threshold to acetycholine, the chemical mediator which allows a nerve impulse to "jump" from nerve fibre to muscle tissue. Cholinesterase destroys acetylcholine; thus, physostigmine and neostigmine, being inhibitors of cholinesterase, permit acetylcholine to accumulate again to such an extent as to enable nerve impulses to overcome the curare block at the myoneural junction; hence, the cholinesterase inhibitors are antagonistic to curare, a fact which is made use of clinically whenever reversal of curare action is desired.

Therapeutic doses of curare have practically no effect on involuntary muscle and glandular secretions, but higher doses are believed to exert some blocking effect on autonomic ganglia.[3] The drug has no direct action on the central nervous system; consciousness, sensation, electroencephalogram all remain unimpaired, providing adequate respiratory exchange is maintained.[4] The administration of curare is followed by some fall in blood pressure which is at least partly due to the

release of histamine, causing peripheral vasomotor dilatation. This histamine release is also the cause of undesirable and potentially dangerous manifestations, *e.g.*, bronchospasm and salivation; however, dilatation of the blood vessels as a direct consequence of decreased skeletal muscle tone also plays its part in causing fall in blood pressure. Sensory nerves are not affected by the drug.

Oral administration of curare has no effect since the drug does not penetrate intact epithelium; it is not destroyed by any of the digestive juices. After injection, the kidneys and liver are responsible for the elimination of the drug, but the exact mechanism of detoxification awaits further investigation.

Following the injection of curare, heaviness of the eyelids, diplopia and blurred vision are perceived. As curarization proceeds, the muscles of the face, tongue, pharynx, lower jaw, neck and back, and extremities become relaxed in about that order. With higher doses of curare the intercostals and finally the diaphragm are affected, resulting in respiratory arrest. The maximal effect is obtained about five minutes after injection. These signs recede in reverse order of their appearance, and within 30 minutes the maximal effect of the curare has disappeared.[5]

From this description it will be seen that the clinical picture is identical with the picture of myasthenia gravis, the manifestations of which will be greatly exacerbated by even minute doses of curare; the disease, therefore, is a contraindication to the use of any of the curare-like drugs.

Standardization of d-tubocurarine by chemical methods, in addition to biological assay which is based on the head-drop of rabbits, demonstrates that 3 mgm. (chemical assay) of the salt are equivelent to 20 units (bioassay).

CLINICAL USE.

The value of curare is its ability to produce controlled skeletal muscle relaxation. In patients who cannot relax when

awake or who have muscular spasm, the use of curare greatly facilitates the process of intubation. With a relaxed patient, traumatic intubation, struggling movements, and expulsive coughing are usually minimized.

Laryngoscopy: Laryngoscopic procedures are greatly facilitated by the relaxation afforded by curare. In patients who have rigid neck muscles and in short, thick-necked patients, exposure of the anterior commissure is most difficult without relaxation. In laryngoscopy it is undesirable to introduce an endotracheal tube for artificial respiration when necessary, since the tube would be in the operative field. While it is true that the actual surgical part of the procedure can be discontinued if it becomes necessary to apply artificial respiration, nevertheless, such interruption often causes trauma to the operative site on the vocal cord; therefore, while relaxation is desired, deep relaxation to the point at which artificial respiration will become necessary must be avoided. As always, safety of the patient is the primary consideration. A satisfactory airway must be maintained at all times, and enough respiratory activity should be present to insure an adequate oxygenation.

One disadvantage in the use of curare in laryngoscopic procedures is that the patient may be unable to phonate adequately during operation on the vocal cords at a time when one would wish to see the results of the surgical procedure upon the cord. For example, in the removal of a polyp, it is desirable to view the tense, phonating cord on completion of the operation to determine whether the edge of the cord is entirely straight. Adequate local anesthesia and a correct dose of curare will permit this in the most satisfactory manner possible; however, larger doses of curare, or curare and pentothal, will make this impossible, with the result that the entire procedure has to be done on a loose, flaccid cord without determining the end-result as aided by phonation.

Bronchoscopy: Bronchoscopic procedures can, for the most part, be done under local anesthesia in adults, and without anesthesia in infants and children. Again, however, the

anatomical problems of the rigid, short-necked patient or the patient with many protruding teeth and a high- narrow palate which make certain laryngoscopic procedures difficult, present the same problem in bronchoscopy. Thus, the relaxation afforded by curare simplifies the introduction of the bronchoscope in the difficult case. Adequate local anesthesia of the pharynx, larynx, trachea and bronchi is again an essential feature in patients who are to have curare. The substitution of pentothal for adequate local anesthesia is dangerous because of the violent expiratory spasm, laryngospasm and other reflex action which follow stimulation of the mucosa of the airway if the mucosa is not made insensitive by the local anesthetic agent.

Esophagoscopy: Esophagoscopic procedures present a number of varied indications for the use of curare. The anatomical difficulties of introduction of the esophagoscope are the same as those for laryngoscopy and bronchoscopy. The fullness of all pharyngeal structures in the obese individual is often an added problem. In esophagoscopy, rigidity of the neck not only makes introduction of the tube difficult but often makes it impossible to advance the tube into the stomach. This is due to the fact that the distal third of the esophagus points anteriorly and to the left, necessitating hyperextension of the head as the scope approaches the cardia.

In addition to the factors of instrumentation, curare greatly facilitates the removal of foreign bodies impacted in the esophagus. This is particularly true of such objects as bones and dental bridges which, because of their many sharp points, require maximal relaxation for safe removal during instrumentation. It is imperative, however, that an airway be maintained. Endotracheal technique is preferred in many cases for protection against possible laryngeal spasm and tracheal compression by the esophagoscope and the possibility of aspiration is decreased.

DISADVANTAGES.

The chief disadvantage of curare lies in its depression of respiration in overdosage. When the activity of the muscles

of respiration is decreased, the diminished tidal volume and respiratory depression can place the patient in a dangerous condition, in that hypercarbia and hypoxia result. This state may cause pathologic alterations if allowed to persist. When the respiratory muscles are completely curarized, respiration ceases and, unless prompt combative measures are instituted, temporary or permanent damage or even death may ensue.

Curare does not produce sleep, sedation, analgesia, hypnosis, or amnesia. If these effects are required, other drugs must be used to attain these ends. There is no absolute protection against laryngospasm. Many clinicians are under the impression that a curarized patient is protected against laryngospasm; this is an erroneous and dangerous belief as this unfavorable reaction can and does occur.

Because of peripheral pooling due to decreased muscle tone, return circulation to the heart is diminished; this in turn produces decreased cardiac output with its resultant hypotension. Another disadvantage of some curare drugs is in their histamine-liberating actions, the most serious of which results in increased secretions into the respiratory tract, in bronchospasm and in hypotension.

COMBINED TECHNIQUES.

Other drugs used in conjunction with curare are the topical anesthetic agents and sodium pentothal, or similar sleep-producing agents. A thorough topical anesthetic with such agents as pontocaine or cocaine is mandatory.

The administration of pentothal with curare adds a very definite hazard of which both the endoscopist and anesthesiologist must be aware. There is an increased danger of laryngospasm with pentothal, especially in the lighter stages of anesthesia. Pentothal has a depressant effect upon respiration and circulation. An insufficient tidal volume is produced when respiratory depression is superimposed upon the already existant depression caused by curare; hence, the combination of

pentothal and curare is pharmacologically bad and dangerous to the patient. Even in skilled hands this technique is most hazardous.

PREPARATION OF THE PATIENT.

A good history and a routine physical examination of the patient are assumed. In addition, the patient should be critically questioned concerning any previous endoscopic operative or anesthetic procedure, and an evaluation should be made of any untoward reactions. The mouth should be examined for loose teeth or foreign bodies, and the mobility of the neck and temporomandibular joint should be established. The possibility of myasthenia gravis should be eliminated because in that disease curare is contraindicated.

As in any procedure that may produce respiratory arrest and circulatory depression, the following precautions must be taken: Equipment necessary to establish artificial respiration with oxygen should be on hand, and tracheotomy equipment and endotracheal tubes must be available for immediate use; intravenous fluids and vasopressor drugs may be necessary; Prostigmine, the pharmacologic antagonist for curare, is useful on some occasions and should be readily available; when Prostigmine is used, atropine is given to antagonize the secretory and other effects of the Prostigmine; in addition to all these resources, an anesthesiologist who is trained in the indications for and skilled in the management of resuscitation should be present.

The psychic preparation of the patient is a very important part of the technique. A short explanation of the procedure is of value. In bronchoscopic procedures he must be told that it will be impossible for him to talk because of the position of the bronchoscope between the vocal cords. When curare is used the patient should be forewarned of the relaxing effect of the drug, the sensation of weakness, heaviness, and heavy eyelids, inability to raise his head, and depression of respiration. Reassurance is equally important during the procedure itself and may be more valuable than administering drugs. It is mandatory to know the patient and obtain his confidence.

The preparation of a patient for an endoscopic procedure should be as thorough as for any surgical procedure. No food or liquids should be taken orally for a minimum of four hours before the scheduled time. Premedication is suited to the individual patient. Sedation in the form of a short-acting barbiturate such as nembutal or seconal is helpful. A dose of 1.5 to 3 gr. may be administered parenterally not less than two hours before the topical anesthetic. The barbiturate will also help to antidote toxic effects of the topical anesthetic agents.

Adequate doses of atropine or scopolamine should be prescribed. An average adult can tolerate as much as 1/100 gr. with no difficulty. This is necessary to decrease secretions and vagal tone.

Curare has a histamine-liberating factor and since histamine may have deleterious effects, *e.g.*, bronchospasm and hypotension. The liberation of this substance has only unfavorable features. If antihistaminic drugs are administered preoperatively, these detrimental factors will be held to a minimum. Antihistaminic drugs are useful only if given prophylactically and are noneffective if given after the curare. Benadryl, histadyl, pyrabenzamine or similar agents are probably satisfactory.

The use of morphine sulphate in premedication for these cases should be avoided. The common circulatory side reaction of morphine that may interfere with the procedure is diminished vasomotor tone with subsequent decrease in blood pressure. The respiration may be depressed. Nausea and vomiting occur frequently. Morphine is a parasympathomimetic drug and as such tends to enhance vagal reflexes and bronchospasm; therefore, if sedation only and not analgesia is indicated, it is wiser to use a barbiturate to obtain this end than an opiate.

TECHNIQUE.

A thorough topical anesthetic to include the pharynx, larynx, and trachea and bronchi is the most essential requirement. A simple technique is employed, using a minimal amount of

anesthetic agent to accomplish a maximal effect. The pharynx is first sprayed with solution by means of an atomizer, using a topical anesthetic agent. Care is taken to direct the spray onto the posterior pharyngeal wall and base of the tongue. After three minutes the larynx is sprayed with the same agent, directing the atomizer tip toward the larynx as the tongue is held forward with gauze. After a second three-minute interval the larynx is visualized with the laryngeal mirror and 2 cc. of 10 per cent cocaine instilled onto the larynx and into the trachea drop by drop. If the patient is to have a bronchoscopic examination, the last cubic centimeter can be instilled as the patient leans first to one side and then to the other to allow the anesthetic agent to flow into each main bronchus. Unnecessary delay in starting the endosiopic procedure after this routine will result in a loss of operating time.

An intravenous infusion is started to provide a readily available channel for drugs or antidotes. The d-tubocurarine is administered, using the clock as a guide. Give an initial dose of 1 cc. (3 mg.) and wait three minutes; then give two-thirds of the estimated dose (0.13 mg. per kilogram of body weight) and wait four minutes. Succeeding doses of 1 mgm. should be given with caution and with three-minute periods of waiting. Enough curare should be given to depress the hand grip to the point where the patient can just squeeze one's fingers and is unable to raise his head; at this point administration must be stopped. Diaphragmatic movement still persists, and respiration is usually adequate. The respiration, eyelid tone and head-raising ability should all be carefully observed. Only the minimal amount of curare should be used to produce the required effect. Oxygen can be insufflated during the induction period.

As the drug is administered intravenously and has a long effect, it is much better to approach the required dose *slowly*, than to obtain an overdose with its subsequent hazards. The anesthesiologists should be allowed enough time to relax the patient gradually and safely. One should count on taking 15 minutes by the clock to get the patient ready.

During the procedure adequate respiratory exchange should be insured. Oxygen can do no harm in the preparation for and during endoscopy. As cyanosis might occur, this sign must be watched for, but its absence means nothing. A finger must constantly be on the patient's pulse to know what the circulation is doing and the other hand on the costal margin to determine respiration. This is especially important in a darkened room, in which case the anesthesiologist should also listen to the respiratory exchange.

The original dose will last at least 20 minutes. If more is needed at that time successive small doses can be given in order to maintain adequate relaxation. At the end of the procedure it is good protection against respiratory obstruction to place an airway in the patient's pharynx. Any secretions should be aspirated at that time.

The anticurare drug prostigmine must not be relied upon as an antidote to curare. Assured, adequate respiration is the antidote to curare. Drugs such as prostigmine and RO 2-3198* have proved very valuable. It is our choice to use a mixture of 1 cc. of the 1:2 000 prostigmine with 10 mgm. of RO 2-3198. This mixture seems to give rather prompt and lasting effect in antidoting curare.

DI-METHYL TUBOCURARINE IODIDE.

D-tubocurarine is the standard drug referred to in this paper; however a newer drug, Di-methyl tubocurarine [Metabine (R), Mecostrin (R)], has lately been used by the authors. Di-methyl tubocurarine, as with d-tubocurarine, has the advantage of having a pharmacologic antidote and can be repeated safely.

Di-methyl tubocurarine is superior in its safety as indicated by the therapeutic index. This is demonstrated by the fact that there is a substantial margin between the effective relaxing dose and a dose producing profound respiratory depression. The action of this drug can be more accurately pre-

*Anticurare drug in experimental state and not yet released. Product of Hoffmann La-Roche, Inc.

dicted. Also, Di-methyl tubocurarine is better in that it has a shorter duration of action and has less histamine-releasing effect.

The ratio of dosage is 1 mgm. of Di-methyl tubocurarine to 3 mgm. of d-tubocurarine; therefore, in the curare induction for endoscopy a test dose of 1 mgm. is given, followed by a three-minute wait, then two-thirds of the estimated dose as calculated, followed by another period of waiting. At present, Di-methyl tubocurarine is considered the best of the group of relaxing agents and is the drug of choice.

OTHER RELAXING AGENTS.

Decamethonium Bromide (C 10) Syncurine (R): This drug has the shortest action of the group. It should be diluted before administration to obtain a more carefully regulated dose. Decamethonium bromide has the advantage of little histamine-producing effect. The disadvantages are many, however, and include no available antidote except artificial respiration and oxygen, noticeable blood pressure fall, and small therapeutic margin. Its action is the least predictable in controlled experiment.

Flaxidil: This drug is very similar to d-tubocurarine in duration of action, predictability and pharmacologic antidote. There are advantages not shown by the other drugs in the group. The blood pressure tends to rise instead of fall. Flaxidil seems to have a predisposition for the head and neck muscles, and this facilitates intubation without diaphragmatic depression. Anothed advantage is the depressant effect on the parasympathetic division of the autonomic nervous system.

SUMMARY.

The basic purpose of curare and curare-like drugs is to produce muscular relaxation and facilitate endoscopy. The use of these drugs is discussed. The necessary cautions in the preparation of the patient and the precautions to take in case

of emergency are enumerated. A technique of administration is suggested. The pharmacologic properties of d-tubocurarine, Di-methyl tubocurarine iodide, decamethonium bromide and flaxidil are compared.

Clinically and experimentally, Di-methyl tubocurarine iodide is the drug of choice.

BIBLIOGRAPHY.

1. Bennett, A. E.: *Jour. A. M. A.*, 114:322, 1940.
2. King, H.: *Jour. Chem. Soc.*, 2:1381, 1935.
3. Burstein, C. L.: *Anesthesiol.*, 11:409, July, 1950.
4. Smith, Scott: *Anesthesiol.*, 8:1, Jan., 1947.
5. Unna, K.: *Jour. Pharmacol. and Exper. Ther.*, 98:318, Mar., 1950.

REPAIR OF THE TRAUMATIZED LARYNX.*

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Prior to World War II there was a dearth of literature concerning injuries of the larynx. Textbooks universally either failed to mention this type of injury or hastily passed over it. The reason for this is the high death rate from these injuries in World War I and the sporadic cases of laryngeal injuries encountered during civilian practice. Between World War I and World War II there was still little to be found concerning these injuries in the medical literature; however, World War II served as a stimulus so that many more articles have appeared during the past six years than in the preceding 20 years. These reports[1-19] have contributed valuable information concerning laryngeal injuries, and experience in the treatment of such wounds is gradually accumulating. With the increased speed of travel by air as well as by land, and with increased mechanical and chemical power, laryngeal injuries which occur now, if they are not fatal, are usually far more extensive than previously.

Laryngeal injuries may be classified as lacerating wounds, incised wounds, penetrating wounds, contusions and crushing wounds. Such injuries have occurred as the result of striking the windshield, dashboard, steering wheel or rear seat in automobile accidents. Railway accidents usually produce crushing wounds; airplane accidents, crushing wounds, lacerations or burns. Injuries occurring in the household, on the farm, or during athletic events, altercations and suicidal attempts have also involved the larynx. Medically laryngeal injuries have resulted from high tracheotomy, endotracheal anesthesia or

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explosive anesthetics, delivery, irradiation burns or accidental severance of the recurrent laryngeal nerve. Thus, such accidents are an ever present possibility; therefore, the care of these victims is of interest not only to the laryngologist but also to the general surgeon whose responsibility is the first aid care and often the performance of lifesaving procedures in such cases. These patients usually die from asphyxia or hemic drowning. Asphyxia results from displacement of tissue, emphysema and compression, submucosal hemorrhage or hematoma blocking off the airway; drowning is due to injury to large vessels. The employment of emergency measures to prevent death from such complications usually falls to the general surgeon or resident on emergency call who, in an attempt to save the patient's life, may do a great deal of damage so far as later care is concerned.

Control of hemorrhage is as important as establishment of an adequate airway, because if either one is neglected for long, the outcome may be fatal. Hemorrhage may be controlled by clamping or pressure as first aid measures, and ligatures should be applied, if possible, but their application may be delayed for a more opportune time; however, the airway requires immediate attention. In such cases tracheotomy is truly a lifesaving procedure and often a race with time. The patient's head should be extended as far back as possible, after which the thyroid notch, prominentia laryngea and cricoid cartilage should be palpated. In dire emergency by an untrained technician the space between the thyroid cartilage and the cricoid cartilage is the easiest and most accessible point of entrance. A transverse rather than vertical incision should be made not only because in this way injury to either the thyroid cartilage or the cricoid cartilage may be avoided but also because there is less likelihood of damaging the inferior laryngeal artery, as the incision is made parallel to this vessel. High tracheotomy should always be a temporary procedure and should be corrected as soon as time permits into a low tracheotomy. The latter is the procedure of choice whenever possible and should be made low, as far from the site of injury as possible. This places the laryngeal car-

tilages at rest and facilitates later surgical repair if necessary by placing the tracheotomy wound as far away from the operating wound as possible; therefore, the incision should be made between the third and fourth tracheal rings or even lower in patients with long necks. The thyroid isthmus should be split, bleeding controlled by continuous sutures and the pretracheal fascia sutured over the cut surface of the gland to the strap muscles and the muscles in turn sutured to the subcutaneous fascia. This helps prevent emphysema and in the presence of a possible infection secondary to the wound helps to seal off the fascial planes adjacent to the trachea.

Shock is the next consideration. Despite statements to the contrary, there is a greater degree of shock in these patients than would be expected from the extent of the laryngeal injury. Trauma to the larynx itself seems to produce this shock. Convulsions and early stages of shock are frequently seen in these patients, especially if attempts at surgical intervention are begun before the patient has been deeply anesthetized or if insufficient time is allowed between local infiltration and the onset of operation. Then, too, these patients are extremely apprehensive, either because they know they are expectorating blood or they are having difficulty in breathing. Shock should be treated by establishment of an adequate airway, control of hemorrhage, reassurance, application of heat and administration of transfusions and warm infusions. Morphine or other opiates are contraindicated except in small doses because of the possibility of decreasing respirations and depressing the cough reflex. Sedatives in small doses given frequently are more advantageous at this stage and should be discontinued as soon as the patient begins to react from shock.

Following these emergency measures the larynx may be carefully examined. In open wounds or in those partially healed the diagnosis of laryngeal injury can be made on external inspection. In healed wounds there may be a tracheotomy because of narrowing of the lumen. In recent wounds careful inspection should be made as much to determine the amount of tissue and cartilage remaining as a basis from which to

begin reconstruction as to determine the extent of injury and loss of structure.

With the present use of the chemotherapeutic and antibiotic agents, the immediate care of these patients has changed. All structures should be preserved as much as possible. Debridement is indicated only in extremely contaminated wounds or in cases in which foreign material has become embedded in the tissues *en masse*. Even in these cases debridement should perhaps be incomplete, in the strict surgical sense, in order to preserve tissue. All structures that appear to have a chance of survival should be preserved and especially is this true of cartilage, which is extremely difficult to replace. If infection does occur, it is usually localized; in such cases soft tissues should be drained and cartilage removed as sequestra. It is surprising how often little or no infection will develop despite contamination, and when it does, how little devitalized tissue results. This is largely due to the use of chemotherapeutic and antibiotic agents.

Palpation will determine the amount of emphysema and its extent if present. With secondary swelling, the normal contour of landmarks of the neck may become obliterated. The cricoid, the cricothyroid space, the contour or the outline of the thyroid cartilage and thyroid notch as well as the thyrohyoid space may be palpated. The examiner should determine extent of laceration, displacement of cartilage, destruction of soft tissue and presence of foreign bodies.

Following inspection, indirect examination of the larynx should be attempted; however, even with cocainization, in many cases this procedure cannot be accomplished because of secondary swelling or distortion of the parts from injury. Nevertheless, when it can be accomplished, indirect examination often gives valuable information as to function of the remaining or injured structures before direct examination is begun; also, before direct examination is done both anterior and lateral Roentgenograms should be made. These will help to determine how much cartilage remains, whether the cartilages or hyoid bone have been fractured and in many instances the presence of opaque foreign bodies.

The next step in management of these patients is direct examination. This is the most important phase of the examination. As a rule it will give considerable information on the degree of injury and will help in formulating steps for repair or other treatment. Because of the importance of this examination, suspension laryngoscopy is recommended (see Fig. 1). By this procedure a complete picture of all the struc-

Fig. 1A. The suspension apparatus consists of a suspension crane with a horizontal bar. By means of two cranks the bar may be elevated or lowered, transposed forward or backward. The suspension hook consists of a tongue spatula, elevated at its tip for engaging the epiglottis, a flexible mouth gag and an arm with a hook for attachment to the crossbar. Midway in this arm is a bat ring screw for changing the fulcrum and elevating the epiglottis.

tures can be obtained through a wide open mouth with no part of the instrument in the field of examination, and most important of all, both of the examiner's hands are free to make a careful examination. Furthermore, the examiner may sit before the patient and take time to make a thorough examination. In this way the mouth, base of the tongue, pharynx and hypopharynx as well as the opening of the esophagus may be thoroughly visualized. Next in order, the arytenoids,

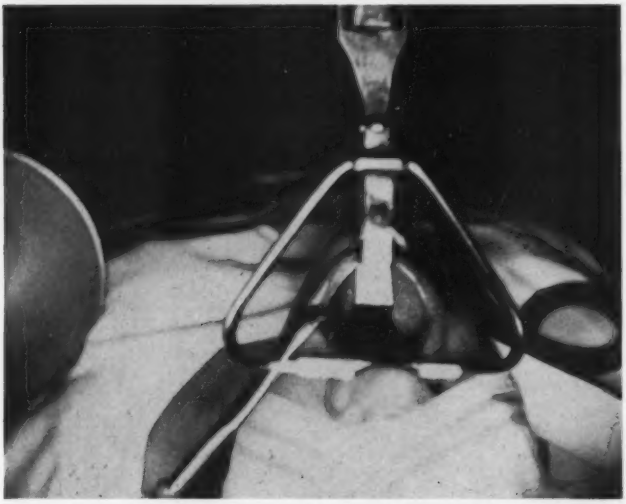

Fig. 1B. The suspension apparatus in place showing the wide open mouth, the hypopharynx and opening of the esophagus as well as the interior of the larynx and vocal cords. The importance is the ability to sit before the patient and have both hands free to make a careful examination.

ventricular bands, ventricles and vocal cords should be examined. The cords may be retracted and the area beyond studied more conveniently and as completely as with any other method. Fixation or displacement of the arytenoids, paralysis of one or both cords, cicatricial bands, webs and the degree of stenosis can be noted.

By means of external examination and palpation, Roentgenography, indirect examination and finally direct visualization, formulative plans can be made for reconstruction. Although no two cases are alike and each must be managed individually, there are certain procedures which apply to all cases. After an adequate airway has been established, and hemorrhage and shock have been controlled, it is necessary to determine whether the esophagus has been injured. If this has not been determined prior to examination, it must be established at examination. By means of suspension it is easy

to introduce the esophagoscope to the level of the suprasternal notch; in other words, the area posterior to the larynx and trachea should be visualized at the time of direct examination of the larynx.

Esophageal injuries should receive attention first. Fortunately, the esophagus is only rarely injured and usually this occurs only in the severest types of cervical injuries. If the injury is small and a fistula is present, this should be excised and the wound closed, but a feeding tube should be left in place from five to seven days. If the esophagus has been severed completely, it should be closed from the posterior surface to the anterior surface; the musculature of the posterior surface should be sutured first, then the mucosa of the posterior

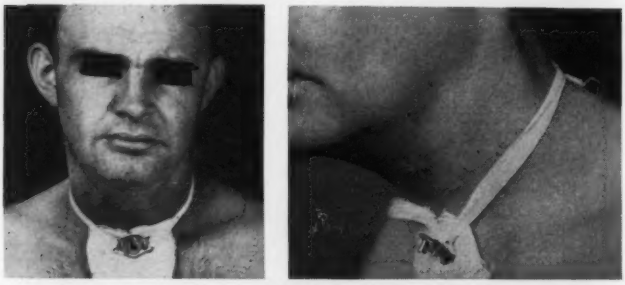

Fig. 2. Contusion of the thyroid cartilage with simple linear fracture of the alar, complicated by hematoma involving the false cord with obstruction to the airway. Tracheotomy was necessary. The hematoma was large, the surface was scarified and a deep puncture made. Drainage and absorption were slow but the swelling subsided. Decanalization was accomplished, the voice remains good, the airway normal.

and lateral walls, followed by the mucosa of the anterior wall, and lastly, the musculature of the anterior wall. The feeding tube should be left in place for 10 days and the wound carefully examined for stricture before the laryngeal injuries are treated if these happen to be extensive. These wounds are usually stab wounds made with a blunt or sharp instrument and as a rule there is little loss of laryngeal or tracheal tissue so that they may be repaired at the same time; however, if a portion of the esophagus has been destroyed, its repair should

be completed before reconstruction of the larynx is begun. The esophagus should be repaired by means of a skin flap brought over from the surface of the neck or a tube graft from the shoulder or back, as indicated. If a flap is used, a two-stage procedure should be employed. The flap should be sutured first in the bed of the esophagus and attached above and below to the severed ends of the esophagus. This should be left alone for two months after it has taken. Then the flap should be cut, folded over a large rubber tube (size 48 to 50 French) and sutured so that the lumen is composed of epithelium and the raw surface is external. This may be allowed to heal by itself or healing may be hastened by means of skin grafts. It may be necessary to dilate this tube, especially at

Fig. 3. Stab wound of the neck, piercing the thyroid cartilage with laceration of the mucosa of the larynx. Hemorrhage and secondary edema necessitated tracheotomy. The laceration of the larynx was sutured intrinsically by means of suspension laryngoscopy and the external wound was closed with insertion of a silkworm drain. Healing was uncomplicated. The tracheotomy closed, the patient has a good voice and the airway is adequate. The cord was not injured.

its attachment above and below to the esophagus, but surprisingly enough this is uncommon if the lumen is made large enough from the start.

After closure of the esophageal fistula or repair of the defect, attention may then be centered on the larynx. Low tracheotomy should be performed first if this has not already been done. Then repair of the larynx may be begun. A frequently overlooked injury is fracture of the hyoid bone. This can be determined by the expectoration of blood, injury of the pharyngeal mucosa, disturbance of phonation, pain when the

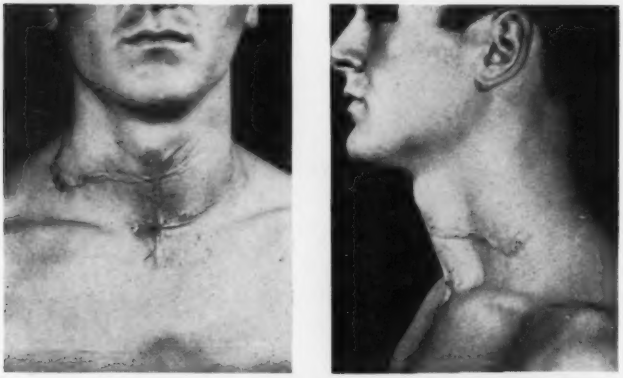

Fig. 4. Gunshot wound of the neck involving the esophagus, posterior portion of the wing of the thyroid and the arytenoid. Following tracheotomy the injury to the esophagus was repaired. After this healed and it was determined that the lumen was adequate, the larynx was repaired. Laryngofissure was performed, the scar of the arytenoid and false cord on that side was removed and skin was grafted. As soon as the skin graft had taken, cartilage was grafted to support that side of the larynx. The patient now has a good airway and a surprisingly good voice considering the extent of injury and loss of tissue.

tongue is extended or moved from side to side, and immobility of the epiglottis. Roentgenograms will confirm the diagnosis. If the fractured hyoid bone is associated with much displacement of fragments and it is impossible to reduce the fracture, it may be wired; however, in the majority of cases, by the pull of the muscles the fractured segments will reduce

themselves. The simple, single fracture should be left alone, as healing will occur and symptoms will be relieved in a relatively short time.

Laryngeal injuries have been divided into those above the hyoid bone, those of the thyroid cartilage, those through or below the cricoid cartilage and those of the trachea; however, because of the relative shortness of the neck, many of these injuries overlap or may even involve all structures. As a

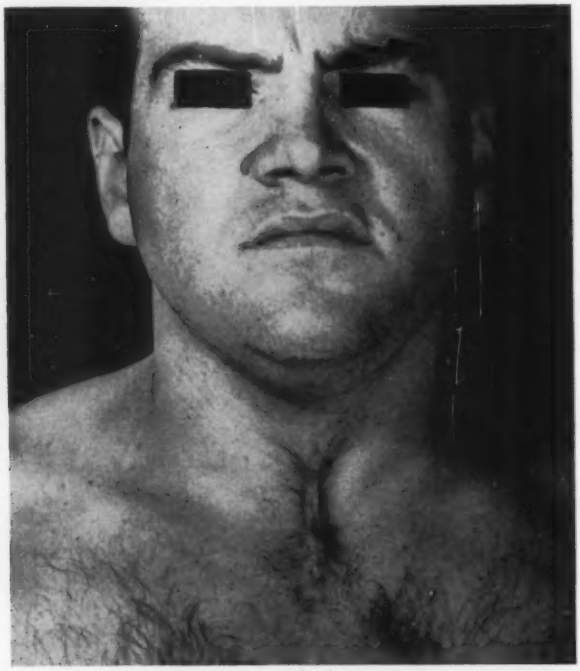

Fig. 5. Crushing wound of the neck involving the thyroid cartilage. Following tracheotomy, laryngofissure was performed; the segments of the thyroid cartilage were restored to position and held in place by means of a laryngeal stint. Secondary infection resulted in loss of only a small segment of cartilage. This infection was drained as soon as detected and the chemotherapeutic dosage increased. The patient has good support and a good airway, but only fair phonation due to laceration of the mucosa at the time of the accident. The stint resulted in scar fixation of the laceration intrinsically and the cords are only moderately involved.

working classification, these injuries may be divided into: *1.* wounds from without, involving the cartilages or hyoid bone without intrinsic laceration or injury, *2.* wounds producing laceration or injury to the interior surface of the larynx, *3.* wounds producing little or no external injury but causing displacement and laceration of the interior surface, and *4.* a combination of the first two or all three of these types of injuries.

Wounds of the frontal surface of the neck with no damage to the cartilage and without intrinsic laceration should be debrided and sutured. During debridement as much tissue as possible should be conserved because the structures encountered in this location are so compact and so closely related that extensive removal of tissue often does more harm than good. Following debridement, sulfonamides should be implanted in the wound and the wound sutured. The systemic administration of penicillin is also indicated.

Wounds of the frontal surface of the neck heal without undue complications and the prognosis is good; however, extensive debridement may convert a simple injury into a complicated one or may result in paralysis of the cricothyroid muscle through injury to the external branch of the superior laryngeal nerve.

Next in severity are wounds of the thyroid cartilage, which may be either open or subcutaneous. If there is no intrinsic injury, the prognosis as to voice and eventual adequate airway is good, since laryngeal edema usually develops immediately after injury. Recovery is rapid; however, these patients should be examined frequently and watched closely for the possible appearance of edema or hematoma, either of which may interfere with breathing. At the first signs of respiratory distress tracheotomy should be performed. This prevents tugging and possible displacement of the fractured thyroid cartilage and places the larynx at rest; the edema then usually rapidly subsides and the hematoma quickly disappears. These patients should also be carefully observed for the development of perichondritis or chondritis, which is not easily detected,

since often the only positive sign is persistent, slight tenderness, later becoming progressively more severe. Usually this is localized and the temperature, blood picture and sedimentation rate remain normal. There is still considerable controversy regarding the time and advisability of operation in the presence of this complication. It has been my experience that more of the cartilaginous structures can be preserved by early operation with drainage and chemotherapy than by waiting for complete walling off of the infection and slough.

Injury to part of, or shattering of the cricoid cartilage presents a serious problem. There is likely to be some form of web present and often complete cicatricial stenosis of the larynx. At the point where there is loss of support the larynx collapses and this may be extensive. As a result of shattering the stenosis is much more severe than the stricture resulting from high tracheotomy and repair is more extensive and prolonged. In such cases cartilage graft, or acrylic or tantalum implant, preceded by skin graft, is necessary.

Injuries involving the integrity of the laryngeal cartilages are, next to complete excision of the larynx, the severest types of laryngeal trauma and are often fatal. In such cases establishment of an airway by skin grafts, graduated molds and cartilage grafts taxes the ingenuity of the surgeon and the patience of the injured. If the epiglottis and arytenoids are not injured, an airway may be established, but if these structures have been severed or destroyed, a functioning larynx cannot be obtained. Without the epiglottis and with paralysis of the arytenoids an airway may be established, but liquids will be repeatedly aspirated. Correction of this causes the airway to be inadequate; however, these patients do well with a tracheotomy tube, are able to speak, and with the narrowed airway above the tracheotomy tube, are able to eat and drink with no discomfort.

The most extensive laryngeal injury is one which also involves the trachea. Frequently, in such cases, in addition to the esophagus, the cervical vertebrae are injured. These patients usually die at the site of injury and rarely reach a

hospital. If they do not die, they should receive the same treatment already described except that it should be more extensive. Repair of the trachea has been accomplished experimentally with fascia lata. Acrylic and tantalum molds have been used for support but these have not been accomplished on the human.

In those cases involving shattering of the cricoid cartilage, injury to the entire larynx and injuries of the larynx and trachea, the esophagus is usually also involved; the care of this structure has previously been discussed.

Injuries involving the intrinsic surface of the larynx vary from slight laceration to complete cicatricial stenosis. If the laceration is small and emphysema is not present, it is wise to leave it alone; however, if emphysema is present and progressive, tracheotomy should be followed by suturing the laceration either intralaryngeally with the use of the suspension apparatus or by means of laryngofissure after subsidence of the emphysema. Hematoma will absorb, but if it is extensive enough to block or embarrass the airway, following tracheotomy the membrane should be scarified and one or two deep punctures made to facilitate drainage; otherwise, complete absorption will not take place, in which case fibrosis and distortion of the interior of the larynx will result. This in turn causes restriction in the ability to speak and at times interference with respiration because of fixation of one or both vocal cords.

If a web is present, it should be incised anteriorly and a stint inserted. After the tissue around the stint has healed, the web may be excised; if it is not excised, it will have a tendency to recur. If there is a stricture with a lumen and the scar is not too thick or too extensive, it may yield to repeated dilatations. If the scar is dense and thick, however, core molds should be inserted gradually, the size being increased as the scar tissue retracts and yields to the pressure. These molds are well tolerated by the larynx and relatively comfortable to the patient after once being inserted.

Complete stricture, if thin and not too extensive, can be incised with the aid of the suspension laryngoscope and core molds inserted in the manner described in the preceding paragraph; however, if the stricture is dense and extensive, laryngofissure is the procedure of choice. The scar tissue should be completely excised and a skin graft inserted around a mold the size of the uninjured lumen. This should be left in place for two months and removed through the mouth. It is sometimes necessary to insert core molds following this, but often if left in place for this length of time, these are not necessary.

Complications following laryngeal injuries are prone to develop. The fascial spaces, opened from the time of injury, provide pathways for cervical and mediastinal infections. Emphysema may develop at the time of injury or later from an open type of tracheotomy in which the fascial planes are not sealed off, or from too tight suture of the external wound and internal lacerations. Pneumonia is an ever present danger because of the likelihood of aspiration. The mucous glands of the trachea tend to keep the skin graft moist, and the graft, being a foreign body, is liable to slough. Molds the size and conformity of the lumen help to prevent this complication but it is an ever present possibility during the early stages of skin grafting. The operative site within the larynx may become secondarily infected; in such cases the structures must be taken down, the infection overcome, and the procedure begun again. Perichondritis and chondritis, ever present hazards, require immediate drainage in order to preserve as much cartilage as possible. Prophylactic measures against all these complications include suction at the bedside, administration of chemotherapeutic and antibiotic agents both before and after operation, transfusions when indicated, general high protein and high caloric diet, and the use of a closed respiratory system during anesthetization and operation.

Of final importance is rehabilitation of the patient. If no attempt is made to improve phonation, a severe psychosis may develop. Breathing is not enough; these patients also want and should be able to talk. Following completion of surgical

treatment, if necessary or advisable, the patient should be sent to a speech center or speech correction school before final discharge.

REFERENCES.

1. Moffett, A. J.: Series of Laryngeal Injuries, with Description of Endolaryngeal Burns. *Jour. Laryngol. and Otol.*, 60:415-418, Oct., 1945.

2. Lederer, F. L., and Howard, J. C., Jr.: Wartime Laryngeal Injuries. *Arch. Otolaryngol.*, 43:331-343, Apr., 1946.

3. Lewis, R. S.: Wounds of Neck and Larynx. *Lancet*, 1:781-784, June, 1944.

4. Reeves, B.: Penetrating Shell Wound of Neck Involving Larynx. *Jour. Laryngol. and Otol.*, 58:327-330, Aug., 1943.

5. Jackson, C., and Jackson, C. L.: Trauma of Larynx. *Arch. Otolaryngol.*, 38:413-425, Nov., 1943.

6. Lumsden, R. B.: Laryngeal Injury Due to Explosion. *Jour. Laryngol. and Otol.*, 57:385-386, Aug., 1942.

7. Nach, R. L., and Rothman, M.: Injuries to Larynx and Trachea. *Surg., Gynec. and Obst.*, 76:614-622, May, 1943.

8. Evans, C.: Treatment of Wounds and Injuries of the Larynx and Trachea. *Med. Press*, 209:91-93, Feb. 10, 1943.

9. Trutnev, V.: Gunshot Lesions of Larynx. *Arch. Otolaryngol.*, 36: 629-631, Nov., 1942.

10. Ormerod, F. C.: Carcinoma of Larynx Occurring 23 Years After Injury at Approximately same site. *Jour. Laryngol. and Otol.*, 56:130-132, Apr., 1941.

11. Rao, B. T.: Injuries of Larynx. *Antiseptic*, 37:753-760, Sept., 1940.

12. Kernan, J. D.: Injuries of Larynx: Traumatic and Therapeutic. The Laryngoscope, 51:292-295, Mar., 1941.

13. Forbes, G.: Unusual Injury to Larynx. *Brit. Med. Jour.*, 1:440, Mar. 22, 1941.

14. Iglauer, S., and Molt, W. F.: Severe Injury to Larynx Resulting from Indwelling Duodenal Tube (Case Reports). *Ann. Otol., Rhinol. and Laryngol.*, 48:886-904, Dec., 1939.

15. Jackson, C.: Trauma of Larynx. *Surg. Clin. N. Am.*, 19:1479-1487, Dec., 1939.

16. Jackson, C., and Jackson, C. L.: Trauma of Larynx. *Indust. Med.*, 8:474-476, Nov., 1939.

17. Jackson, C.: Perichondritis of Larynx, Traumatic and Infective. *Trans. Am. Laryngol. Assn.*, 60:127-143, 1938.

18. King, T.: Cause of Asphyxia in Intubation for Laryngeal Diphtheria; Report of Case. *China Med. Jour.*, 44:241-243, Mar., 1930.

19. Iglauer, S.: X-ray Injury to Larynx with Report of Case. *Ann. Otol., Rhinol. and Laryngol.*, 36:124-132, Mar., 1927.

PRINCIPLES OF THERAPY IN OTITIS EXTERNA.*

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World War II served to overturn two previous concepts concerning otitis externa. The first, which came as no surprise to otologists who practice in the South, was that it was a disease of low frequency and little importance. The second was that otitis externa is chiefly a disease of fungous origin. Actually, otomycosis proved to be a great deal less frequent than bacterial otitis, and fungi are now believed to be of only minor significance in the causation of the disease. The therapeutic implications of this etiologic reversal I shall return to shortly.

The chief reason for the confusion which presently exists concerning external otitis is the conscious or unconscious attempt to gather all its manifestations under the same pathologic umbrella. In reality, external otitis is a general name for a number of different diseases whose chief point of resemblance is that they are located in the external auditory canal. Naturally, since the various observers are often not talking about the same conditions, published reports of the results of similar modes of therapy often vary from miraculous successes to complete failures. The basic confusion, of course, stems from the fact that treatment has been instituted without proper etiologic studies, or without a sufficiently wide experience to justify the expedient of treatment without such an investigation.

It seems fair to add that additional confusion is caused by the rather general medical failing of rushing into print with

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reports of agents which often have not been tested for long enough periods of time to warrant any conclusions at all, let alone sweeping statements concerning their efficiency.

These pessimistic observations do not mean that the therapy of external otitis has not been greatly clarified within recent years; it has been. Among the extremely valuable contributions to this subject are the studies of McBurney and Searcy,[1] in 1936, the continuing contributions of W. D. and E. K. Gill,[2-7] and the recent investigations of Senturia and his associates.[8-13] No one should attempt to treat this disease without familiarizing himself thoroughly with these studies; moreover, the introduction of efficient chemotherapeutic and antibiotic agents and of the newer chemical and synthetic agents has eliminated the necessity for the use of many of the agents formerly employed, often empirically and often with no very valid indications for their use.

DIAGNOSTIC PROCEDURES.

The treatment of external otitis, regardless of the variety, will be greatly simplified if certain steps are followed routinely in its management and if certain general principles form the basis of every therapeutic regimen.

The first step in the management of any case of otitis externa is: *1.* a careful history, with special attention to possible etiologic factors, *2.* a general otolaryngologic examination, and *3.* a careful local examination, supplemented by magnification. The data thus secured usually permit an accurate clinical diagnosis, though it must be remembered that the clinical picture will vary according to the duration of the disease and its treatment before the patient is seen.

As an academic matter, laboratory studies are desirable in every case. In private practice, for a variety of reasons, including the cogent one of expense, there must be some compromise with the ideal. Fortunately, it is usually possible to determine by clinical observation, particularly if gross inspection is supplemented by magnification, what sort of infection

one is dealing with, and it is entirely proper to begin treatment on the basis of the clinical impression, with a considerable saving of time as well as of expense. This short cut, however, is permissible only for otologists who have had a large experience in otitis externa. Competence in clinical diagnosis comes only with experience, and treatment without laboratory investigation is not recommended for those who do not possess it.

If the patient's failure to respond promptly to adequate therapy indicates that the clinical diagnosis was not correct, laboratory studies, including both smears and cultures, are instituted without delay. As Gill[6] has emphasized, some molds are slow-growing, particularly the types common in chronic or recurrent otitis externa, and cultures should not be discarded for a minimum of two weeks. Fortunately, the identification of the species of fungus is all that is necessary for therapy; only occasionally is further differentiation required. Two other precautions come to mind from my own experience: the hands should be washed thoroughly with one of the new antiseptic soaps before the culture is taken, and sterile cotton (either autoclaved or secured from the center of a commercial package) should be used for taking it.

GENERAL PRINCIPLES OF THERAPY.

With these fundamental considerations out of the way, we may now proceed to the principles upon which the treatment of otitis externa should be based.

1. The first principle of therapy is that whichever form is employed, it must be related to the etiology of the case under treatment. It is now generally recognized that the majority of cases are of bacterial origin. Not more than 15 or 20 per cent, at most, are of fungous origin. Aspergilli are apparently responsible for most cases in this group, though these fungi can often be obtained on routine cultures of normal ears and their mere presence does not imply that they are pathogenic. Staphylococci are responsible for a considerable number of bacterial infections, but there is a surprising uniform-

ity in bacteriologic studies, both military and civilian, to the effect that one special organism, Pseudomonas, is the predominant organism, or the only organism, present in most cases. Pseudomonas is not present in normal ears, and it is significant that in many studies in which it was found in them, otitis externa later developed while the patients were under treatment for contralateral infections.

2. In addition to the application of therapy on the fundamental principle that an infection is of bacterial or fungous origin, other etiologic possibilities and predisposing causes must also be eliminated or counteracted. It is true that nothing can be done about climate and humidity, the two most important predisposing causes, but bad hygienic habits, lack of cleanliness, and failure to keep the ears dry can readily be corrected and will go far to overcome conditions which cannot be changed. The ears can be protected against trauma, chiefly trauma introduced by the patient himself. Other causes which must be investigated and corrected include anemia, vitamin deficiencies, and various allergies, of which more will be said later. A possible psychogenic origin is surprisingly frequent. In the occasional case of otitis externa one or another of these causes is solely responsible. In many instances they are present in addition to bacterial or fungous invasion. In any event, treatment will be less than adequate when they are not sought for and corrected.

3. Judgment should be used in the selection of therapeutic agents. As Senturia[14] has well expressed it, only those which are worthy of clinical trial should be selected. Those which have no relationship to the conditions present should be rejected. There should be, in short, bacterial and fungous cross-matching. If more than one organism is present, the predominant organisms should be treated. If these principles had been borne in mind, a large number of agents used in the past in the treatment of otitis externa would never have been tested at all, and many of those presently employed would at once be discarded. A review of the literature indicates how little attention has been paid — and is still being paid — to this fundamental precept.

In the same connection, it should be emphasized that whenever it can be avoided, therapeutic agents should be used independently and not in combination, if only for the reason that agents used in combination may cancel each other out.

4. Until quite recently, little attention has been paid either to the pH of the external auditory canal or to the pH of the solutions applied to it. The important studies of Fabricant and Perlstein[16] have shown that these are matters which must be taken into consideration in all therapy. It is not uncommon, in fact, to find that the difference in efficiency of two apparently similar agents can be explained by the fact that one produces or enhances a state of acidity, which is the normal state within the canal, while the other produces or enhances a state of alkalinity, which is unphysiologic and which provides optimum soil for the propagation of infection. Behind every case of external otitis, I believe, are two factors: interruption of the continuity of the epithelial lining and alteration of the pH from the acid to the alkaline side. Once these factors occur, bacteria and fungi have their great opportunity, and it is surprising how often their properties are activated by the use of solutions whose pH is on the alkaline side.

5. Chemotherapy and antibiotic therapy have, paradoxically, lost some of their usefulness because they have been so widely used. Sensitization is now a possibility to be borne in mind in all topical applications. Dermatologists contend that penicillin cannot be used locally much longer than five days without the appearance of erythema, vesiculation, and other evidences of sensitization. I think this is true of all other topical applications. This complication, in fact, has kept me from using, except in very occasional cases, some antibiotics of established usefulness, as well as many of the newer agents such as isopar. A limited experience with them has indicated that patients are highly sensitive to them and that their efficiency would be counterbalanced by this annoying and sometimes serious complication.

There are other reasons for employing antibiotic therapy cautiously. In the first place, the new chemotherapeutic and antibiotic agents are useful, and indeed invaluable, in conditions which are far more serious than otitis externa, or are actually lethal, and their careless use for what is, after all, a minor disease may destroy their usefulness for the special patient in some later emergency. In the second place, all strains of organisms do not respond to agents which are ordinarily effective against the species to which they belong. Some strains are originally resistant and some develop resistance in the course of treatment. When a lack of response to a properly selected agent is observed, cultures should be repeated and sensitivity tests run, to determine to what agent the organism is sensitive, and in what concentration. Drug-resistance to special strains, incidentally, probably explains some of the contradictory reports issued by observers of equal competence and reliability.

6. Otologists who are not familiar with the studies by Senturia and Doubly[11] on the importance of the vehicles used for the agents selected for the treatment of otitis externa would do well to familiarize themselves with them. They showed, for instance, that the incorporation of streptomycin, penicillin or mixtures of these two agents in water-insoluble vehicles results in the complete inhibition of their antibacterial effect against certain organisms. When they were incorporated in water-soluble vehicles, with the exception of propylene glycol, this loss of activity was not observed. Others have contributed along the same lines. Zimmerman,[16] for instance, pointed out that sulfa drugs are released only slowly and in minute quantities when they are incorporated in vaseline and lanolin bases.

One's own clinical experience is not necessarily in agreement with all these observations. Clinically, for instance, I have not found, as Senturia and Doubly's studies showed, that oily vehicles interfere with the fungicidal activity of cresatin and thymol, nor have I found, as Fowler[15] did, that better results were secured with sulfamylon when it was employed in 1 per cent solution of methyl cellulose rather than in carbo-

wax or in aqueous solutions. Nonetheless, the studies to which I have briefly alluded suggest that when poor results are secured with agents which are effective *in vitro* against particular strains of organisms, it might be well to look into the vehicles in which they are being applied.

7. Whatever drug is selected should be used for as brief a period as possible. It requires nice judgment, of course, to decide what is long enough and what is too long, but it is a decision which nonetheless must be made. Long-drawn-out treatment is unnecessary in most cases and, as already pointed out, may be harmful. The normal physiology of the external auditory canal presupposes a dry, intact, horny layer of skin, and treatment should be designed, as far as possible, either to maintain it or not to destroy it any longer than is necessary. The skin is often damaged by the use of wet dressings and ointments, which should always be regarded as temporary measures and discontinued as soon as possible. Strong chemicals may cause a dermatitis to be superimposed on the original bacterial or fungous infection. Desquamation may be a necessary part of therapy, but when the need for it is past, measures should be taken to restore the normal status. In addition to the cessation of active treatment designed to eradicate the infection, the use of a mild coal tar ointment which also contains salicylic acid (such as pragmatar) is often necessary to bring the skin back to normal.

8. Whichever drug may be selected, in the light of the principles just discussed, must be applied in the light of certain other principles. It must be prepared in high enough concentration to affect the organisms against which it is used; there is no magic in solutions which do not meet this requirement. It must be applied in sufficient amounts to reach all parts of the external auditory canal. Contact between it and the diseased tissues must be close and intimate, which is not possible unless the canal has been thoroughly cleansed. It must, as just pointed out, be applied sufficiently long to effect the desired results but not long enough to induce sensitivity. It must be promptly discontinued and replaced by some other

agent when it is evident that it is not accomplishing results, though the trial must be long enough for it to exert whichever therapeutic effect it is capable of.

9. Theoretically there are numerous sound arguments against letting the patient with otitis externa participate in his own treatment, and I grant Fowler's[15] contention that an analysis of cases may contain errors if the otologist has not been responsible for all the therapy. For practical reasons, however, it is simply not possible to see all patients with otitis daily, let alone several times daily, which is how most forms of therapy must be carried out.

This circumstance means that the physician must be extremely careful in demonstrating and explaining to the patient exactly how therapy is to be applied. He must also emphasize to him the importance of doing exactly what he is told — carrying out treatment at the precise times specified, occupying the position demonstrated, and keeping the solution in the ear for the time required. In my own office we avoid misunderstandings by giving the patient written instructions on all of these matters.

My own experience, which I have no doubt is duplicated by others, is that patients are much more willing to carry out treatment, and to carry it out more accurately, if the method is made as simple as possible, and also, if I may so express it, as attractive as possible. Dyes such as gentian violet and merthiolate are conspicuous. Ichthyol ointment and Castellani's paint are messy. From the otologist's standpoint they have the additional, sometimes serious, disadvantage of obscuring the progress of the disease. It is true that sometimes they are necessary. Gentian violet, for instance, together with potassium iodide by mouth, is a very effective treatment of Monilia infections. It is also true that in McBurney and Searcy's[1] studies some of these agents, such as Castellani's paint and merthiolate, rated rather high in the scale of efficiency in otomycotic infections. It would, therefore, be necessary to use them, in spite of their disadvantages, if nothing

else were available; but equally efficient agents, which lack these objections, are now available, and there is seldom any necessity for using undesirable dyes and ointments.

10. Only in the exceptional case is hospitalization required for external otitis. As a general rule, the patient can be completely ambulatory or can rest at home between treatments. Occasionally a patient with severe furunculosis caused by a mixed infection, of with perichondritis, is hospitalized for parenteral antibiotic therapy. Misconceptions which have arisen on this point are probably attributable to the military experience, in which hospitalization for external otitis was fairly frequent. The explanation, of course, is that the circumstances of military and civilian life are widely different, and that certain regimens and precautions entirely compatible with the continuation of normal civilian occupations are often completely impractical for military personnel.

It is perfectly possible to carry out most local treatments and manipulations in the properly equipped office. Sterile precautions should be employed and manipulations should be limited to those which are absolutely required, and should be as gentle as possible, since the superimposition of additional trauma may greatly aggravate the condition and may introduce fresh infection.

ELEMENTS OF THERAPY.

To turn now to the active treatment of otitis externa, it is divided into several component parts, including *1.* the relief of pain or discomfort; *2.* the cleansing of the external auditory canal; *3.* the elimination of the causative agent and the elimination or control of the predisposing causes which permitted it to become established; and *4.* the restoration of the external auditory canal to a normal physiologic status.

My own preference, if it seems that the application of heat by means of a light will not be sufficient for the control of pain, is the use of small doses of X-ray. The exact mechanism by which results are achieved may still be uncertain but there

is no doubt of the effectiveness of this method. Sometimes relief is obtained in as little as three or four hours, and well over half of all patients require only a single application.

I have used this method of relieving pain for a number of years. At first dosages varying from 42 to 62 r. were used. Then the dosage was gradually and cautiously increased, and at the present time I use 100 r. daily until relief is obtained, though in no case does the total dosage exceed 300 r. In addition to the relief thus secured, preliminary X-ray therapy seems to shorten the duration of treatment. The application, of course, must be made by an experienced radiologist, with the proper precautions, and Gill and Gill's[7] warning is timely, that repetition of the method in recurrent attacks is dangerous because of the ease with which the function of the ceruminous glands can be destroyed.

X-ray applications, in addition to relieving pain, are useful when cellulitis is present. They may be supplemented by wicks saturated with some such agent as Burow's solution (1 per cent aluminum acetate).

I am one of those who believe that if it were practical to see patients daily, which of course it is not, it would be possible to clear up most cases of otitis externa merely by repeated daily cleansing. I am aware that some reports in the literature fail to bear out this belief, but, on the other hand, the cures obtained by Senturia and Broh-Kahn,[10] for instance, in control cases in which only carboprop was used do seem to indicate the possibilities of simple cleaning in simple cases. My own opinion, in fact, is that careful cleansing explains the good results reported with certain agents which simply could not in themselves have achieved the cures attributed to them.

Be this as it may, there is no question that almost without exception observers who report good results from any method of treatment emphasize the necessity of cleansing and drying the external auditory canal thoroughly before any applications at all are made to it. There are a number of good reasons for this phase of therapy: *1.* Moisture, maceration, and the accumulation of epithelial debris and dead tissue all offer

excellent conditions for the growth of organisms and for the production of an alkaline environment favorable to their growth. *2.* The removal of debris brings to pass another requirement for effective treatment, that whichever agent is used must be brought into intimate contact with the tissues. *3.* Cleansing of the canal also sets up, so to speak, the most favorable conditions for overcoming the regional anatomic peculiarities which have much to do with the development of the disease. Attempts to relate the anatomic configuration of the infected external auditory canal to the presence of infection in special cases have not been too successful, but the physical and histologic structure of the external ear favors the development of infection and thorough cleansing at least reduces the adverse influence of this tortuous, epithelial-lined, dead-end tube.

Opinions differ over the best method of cleansing the canal. Some prefer irrigations, some prefer suction because they fear the introduction of fluids. I think that this fear, providing that the ear is thoroughly dried afterward, is unfounded.

My own plan, in the usual case, is to cleanse the ear gently by suction, first using the smallest size Frazier tip, and near the attic using a tip devised in my office for this purpose. This tip is malleable and, therefore, can be bent to reach inaccessible areas. Finally, the canal is irrigated with an ounce of 95 per cent alcohol and is thoroughly dried. For the irrigation I use the 2 oz. DeVilbiss bottle, which is easier to handle than a syringe and use compressed air for both irrigating and drying purposes.

This is not a procedure which can be hurried. It must be done deliberately, carefully and very gently. If it is done in this way it is not painful, though it may take as long as 15 or 20 minutes. Lighting must be adequate. If edema is so great that the initial manipulations are limited, a wick is inserted for 24 hours, saturated with Burow's solution, which I prefer because the pH (4.4) is on the acid side. At the end of 24 hours the desquamated membrane can usually be removed manually without difficulty.

Like most other otologists, I believe that cerumen should be removed from an infected ear, along with all other debris. Philpott and Chessen[18] comment rather bitterly on the difficulty of educating both soldiers and medical personnel to its "beneficently bactericidal" properties, but too much evidence exists that bacteria and fungi can grow on wax to make it wise to leave it in an infected ear.

A few words might be said about irrigating solutions. Some otologists feel that the solution remains in contact with the tissues too brief a time to make anything but water worthwhile. In that case, tap water is as good as anything, though it might be well to follow it with alcohol. Some prefer hypertonic salt solution. Others regard it as irritating and use isotonic solution. ST 37 and sodium bicarbonate have been recommended. Many prefer hydrogen peroxide. In McBurney and Searcy's[1] studies a 3 per cent aqueous solution of hydrogen peroxide occupied fifth place as a bactericide and twenty-sixth place as a fungicide. It is undoubtedly a valuable agent in both bacterial and fungous otitis externa, especially because of its ability to dissolve cerumen, crusts, scales and pus. It has no sensitizing properties, and when it is used in the proper concentration it does not harm the skin.

My own preference, as I have indicated, is for alcohol in 95 per cent concentration. It is interesting to note that alcohol has been used in otitis externa since 1874, and that Ballenger, in 1909, called it the remedy *par excellence* for fungous infections.[1] McBurney and Searcy[1] found that, regardless of the concentration employed, alcohol had no effect on any variety of Aspergillus on which it was tested. It is, nonetheless, an extremely useful cleansing agent and it has the great advantage that if any quantity should inadvertently be left in the ear, it promptly evaporates.

McBurney and Searcy,[1] in 1936, tested 69 drugs and combinations of drugs which had been recommended for use in otomycosis up to that time. Offhand, I would say that at least as many drugs and combinations have been recommended since that date.

Before going on to the treatment of special types of otitis externa, we should be reminded that the classification of the disease is notoriously unsatisfactory. The general term does not indicate that this is not a single pathologic entity but a group of etiologically different conditions. On the other hand, clear-cut classification is difficult for several reasons, one of which is the practical one that the various forms tend to merge into each other: an otomycotic infection, for instance, soon becomes bacterial also, as does a primary traumatic or hemorrhagic lesion. An acute infection may become chronic, and a chronic or subacute infection may present acute exacerbations. The American Academy of Ophthalmology and Otolaryngology or the American Otological Society would perform a useful service if an acceptable classification could be devised and generally adopted.

MANAGEMENT OF SPECIAL TYPES.

Circumscribed Otitis Externa. Circumscribed external otitis differs in no respect except location from a furuncle elsewhere in the body, and in the absence of treatment its natural history is the same. In the occasional case it may be possible to abort it by the use of small doses of X-ray. Usually it is seen later, and treatment must begin with the relief of pain by diathermy, external heat, analgesics, and small doses of X-ray, according to indications. Wicks saturated with iodex ointment are inserted into the ear if the epithelium is grossly intact; otherwise, cresatin-soaked wicks are used. Hot compresses may be employed to expedite localization, which is the objective of all treatment. It is sometimes wise to remove the tops of localized lesions, but surgical incision and drainage are practically never necessary.

Recurrent furunculosis demands a search for, and elimination of, possible foci of infection. Diabetes should always be excluded as a possible cause. X-ray applications, three times weekly in 100 r. dosages, to a total dosage of 500 r., will control some cases. Staphylococcic toxoid and autogenous vac-

cines may be tried. If the condition is obstinate it is well to resort at once to one or two intramuscular injections of penicillin (400,000 units).

If furunculosis of the external ear is secondary to otitis externa diffusa or otitis media, the patient should be hospitalized and treated with penicillin (400,000 units) every 12 hours together with streptomycin (0.5 gm.) every six hours, the reason for the combination being that these lesions are likely to be Gram-negative as well as Gram-positive.

Diffuse Otitis Externa. By the trial and error method I have come to limit the agents I usually employ in otitis externa diffusa to sulfamylon for Pseudomonas and other Gram-negative infections, aureomycin for Staphylococcus and other Gram-positive infections, and cresatin, with or without thymol, for fungoid infections. Since I have followed this plan I have had almost uniformly good results, and I recommend it to you as being both simple and logical.

Sulfamylon, my own laboratory studies[19] show, is consistently effective *in vitro* against the organisms commonly found in otitis externa, solutions varying in strength from 4 per cent down to 0.25 per cent effectively inhibiting growth in all the cultures tested. Additional studies showed that the optimum bactericidal effect was obtained when a 1 per cent solution was kept in contact with the bacteria for a five-minute period, about as long, incidentally, as a patient who is not incapacitated by his disease will submit to inactivity at any single time. Although streptomycin would probably be as effective against the bacteria susceptible to sulfamylon, the latter is preferred because its pH is acid, while that of streptomycin is alkaline.

At the patient's initial visit, after careful cleansing, the fungicide of choice (cresatin, with or without thymol) is applied if the disease is thought to be fungous in origin, which most of the time it is not. Otherwise, sulfamylon is applied and the patient is shown exactly how to use it. He lies on the nonaffected side, instills the 1 per cent aqueous solution into the ear, and permits it to remain for exactly five

minutes. The ear is then blotted dry with cotton and a cotton wick is inserted, which is changed often enough to keep it from being saturated with discharge. Treatment is carried out twice a day.

If severe cellulitis is associated with diffuse otitis externa it is well to delay sulfamylon therapy for 24 hours and in the interim employ wicks saturated with Burow's solution. They are kept moist by the application of drops for 15 minutes every two to three hours. Dry cotton wicks are used between treatments.

When the patient returns for his second visit, usually 48 hours later, the further procedure depends upon his progress. The ear, as a rule, is greatly improved, probably as the result of the thorough cleansing as well as of the action of sulfamylon. If the infection is clearly under control the ear is again cleansed, then is dried thoroughly and dusted with sulfanilamide powder. The patient is instructed to discontinue all medication and to make every effort to keep water out of the ear for the next three to four weeks. If the response has been less than satisfactory, the initial treatment is repeated, and the patient returns for further treatment and observation, preferably every 48 hours, until control is achieved.

If good results are not apparent at the second visit, smears and cultures are made and subsequent therapy depends upon the laboratory findings. The report usually shows *1.* mixed organisms with Pseudomonas predominating, *2.* mixed organisms with Staphylococcus predominating, *3.* Streptococcus with the precise type named, or *4.* B. pyocyaneus. If a pure Staphylococcus is reported, or a mixed infection with Staphylococcus predominating, a coagulase test is run. If it is reported negative, the Staphylococcus is disregarded and sulfamylon is continued, as if the infection were Gram-negative. If the test is reported positive, sulfamylon therapy is discontinued and the patient is treated with aureomycin, in the form of ophthalmic solution. I find this method far more effective than the penicillin therapy (intramuscular and parenteral) which I formerly used.

A precaution which should not be omitted after the conclusion of treatment is the healing of any fissures of the meatus which may be present. They are cleansed, cauterized with 10 per cent silver nitrate, and then dusted with sulfanilamide powder.

Otomycosis. If the otitis is thought to be fungous in origin, 1 per cent thymol in cresatin solution is applied to the external canal following cleansing, which must include the removal of all visible scales. A wick saturated with the same solution is then left in place for 24 hours. Blonds, or patients whose skin seems sensitive, are treated with a dilute solution of cresatin (50 per cent) and usually without thymol. After the wick is removed, the solution is continued as drops, applied in the usual manner, twice daily.

The point of this therapy is the keratolytic action of cresatin. Cresatin alone, or thymol alone, or the two drugs in combination, were the most effective tested by McBurney and Searcy[1] against Aspergillus, and in the years that have passed since their investigation no more effective fungicides have been found. If the thymol is too irritating, cresatin alone seems equally useful. In the McBurney-Searcy studies the difference in their *in vitro* effectiveness was only fractional.

Senturia's[8] studies on the fungi most often found in the ear showed that sulfanilamide is markedly effective against aspergillus, penicillium and mucor though not against monilia. He, therefore, recommended a powder composed of sulfanilamide for its fungicidal action, sulfathiazole for its antistaphylococcic action, and zinc peroxide for its oxidizing effect in the proportions 4:4:2. Like Senturia, my experience with this powder has been that, when it is applied, pain is promptly relieved or greatly diminished, edema is decreased, and the discharge becomes much less. The promptness of results is proportionate to the severity of the case. I have found, however, that this is not a stable preparation, and I am beginning to use sulfanilamide powder alone, or the Whalen preparation containing thymol, after cresatin-thymol therapy is discontinued.

Eczematoid Otitis Externa. With the measures just described, about 75 per cent of all patients with external otitis will get well promptly or with reasonable promptness. The remaining 25 per cent furnish most of the problems.

The type of external otitis loosely classified as eczematoid heads the list of these problems. The infections are frequently of low grade and of great chronicity. They require intensive therapy, which must be continued over long periods of time. Often it is necessary to substitute one drug for another. Treatment is frequently complicated by the fact that the patient has had the disease for a long time and has had many previous forms of treatment.

In this type of case the initial investigation is thorough. The general as well as the local condition is surveyed, and such consultations as are necessary are secured. Laboratory investigations include cultures, smears, blood serology, complete blood picture, and hematocrit. Foci of infection are searched for. Allergic possibilities are investigated. Nothing, in short, is omitted which might throw light upon the picture. All medication is discontinued and treatment is limited to simple cleansing and the use of dry wicks until the etiology is established. Cosmetics are discontinued and nonallergic products are substituted. The patient is warned against scratching the ears, and gloves are recommended for night wear to prevent it. A possible psychogenic origin is always suspected in this type of case. My own experience, in fact, indicates that this type of persistent otitis externa does not occur in stable persons.

It is difficult to generalize about the treatment of eczematoid otitis externa, since it depends chiefly upon the underlying cause. It may include the vitamin therapy, especially thiamin chloride, liver extract or thyroid extract. If the skin has become hyperkeratotic, some keratolytic agent should be used briefly, usually some preparation of salicylic ointment. If secondary infection has occurred, aureomycin is preferable to penicillin, since eczema occurs only in hypersensitive patients, who are frequently sensitive to the later drug. Ra-

diotherapy in small doses may be useful. It is difficult to evaluate the forms of therapy suggested in some contributions to the subject since the variety of agents used simultaneously make it impossible to determine the worth of any single drug.

Other Types. The various forms of true allergic otitis externa, with which the eczematoid variety overlaps, are readily treated by removal of the causative agent, followed by strict cleanliness and the application of some soothing ointment. It is my experience that in many instances allergic otitis is induced and perpetuated by the therapy used to treat otitis externa.

Seborrheic dermatitis, which is not a very common variety, can be treated only in combination with treatment of the scalp disease, which is usually primary. Treatment consists of the use of a keratolytic agent followed by a bland ointment, to restore the skin to its normal condition.

Erysipelas, which is a streptococcic infection, is best treated in the ear, as elsewhere on the body, by a combination of sulfathiazole by mouth and penicillin intramuscularly. Traumatic external otitis requires little more than the elimination of the traumatizing agent, after which natural healing is permitted to occur. If infection is superimposed, the treatment is that used in bacterial otitis externa.

In granulomatous otitis externa, gentle, daily cleansing is the most important part of therapy. Pedunculated granulations may be removed with forceps, or may be touched with a probe dipped in silver nitrate or pure carbolic acid. The ear is then dusted with sulfanilamide and dry wicks are applied by the patient as necessary. Healing is slow and new lesions may appear even after it seems to have occurred. In this type of otitis externa the organisms present are usually those which normally inhabit the external auditory canal and, therefore, the use of antibiotic agents is unnecessary. It is usually wise, however, to run a cytologic test, to check for mucus threads, whose presence would indicate an overlooked pin-point perforation of the tympanum.

Hemorrhagic otitis externa (bullosa hemorrhagica) is best treated by mechanical rupture of the bullae, under strict aseptic technique, with a myringotome or some similar knife. Pain is usually promptly relieved. Bonain's mixture is applied for 15 minutes before the incision of the lesions, to anesthetize the parts.

Chondrodermatitis, which is a very painful and quite uncommon condition, responds only to some method of cauterization or complete excision. Chemotherapy and antibiotic therapy are always indicated in perichondritis.

A wide variety of purely dermatologic conditions may affect the ear, and a consultation with the dermatologist is often indicated. The otologist, however, must continue to control therapy, regardless of the consultant called into the case, since treatment of the external auditory canal is always indicated and no other specialist is trained or equipped to apply it.

Up to very recently the treatment of herpes zoster oticus was entirely symptomatic and not at all satisfactory. Recently, on the suggestion of Hilger,[20] I have been using intravenous injections of procaine, ascorbic acid and adrenalin, the precise method depending upon the type of case. Aureomycin is used with this regimen, and the results, in the few cases I have treated by this means, far surpass the results of any other method I have previously used.

THE NEWER DRUGS.

I regret that because of lack of time I cannot discuss the newer drugs recommended for otitis externa. I have not duplicated the good results reported by Reardon[21] and by Walker[22] with isopar, chiefly because my patients have shown such a degree of sensitivity that I could not continue its use. I have had much the same experience with furacin as well as with compound 280 (dibromsalicyladehyde), with which Hayes and Hall[23] have had a favorable experience. Gill's[2] objection to the latter preparation on the ground of its high pH (8.0 to 8.2), which is definitely on the alkaline side, is well taken. Sullivan and Smith,[24] because so many of their

patients were sensitive to it, now use it only as a last resort. The excellent results reported by Ochs[25] from acetic acid, which he used in the form of household vinegar, are so impressive that the method seems well worth a trial. Nelson's[26] results in the Pacific were equally good. The "sloppiest ears," he reported, were often clean, dry and healthy-looking 48 hours after treatment was begun, though he warned that recurrence was likely if applications were not continued for several days longer.

PROPHYLAXIS.

Let me conclude this presentation with a few words about prophylaxis in otitis externa. I doubt that any of the various methods which have been suggested is as effective as the simple plan of keeping the ears clean by the ordinary rules of cleanliness, rinsing them free of soap, drying them carefully whenever they have been wet, and then letting them entirely alone. This prohibition extends to the removal of wax, which should be left undisturbed unless for any reason an otologist thinks it necessary to remove it.

Certain predisposing factors cannot be controlled, such as the temperature and humidity in tropical climates, but special care can be exercised to keep the ears dry when perspiration is profuse. Even those who do not accept swimming as a usual cause of otitis externa — as I do not — would agree that it is well to avoid this exercise during the course of the disease and until treatment is concluded. Some observers believe that methods intended to protect the ear during bathing and swimming actually predispose to infection. My own feeling is that if any such attempt is made it should be limited to the use of lamb's wool plugs. If mothers insist on something more impressive, they may be given a simple solution of mercuric chloride (1:5,000) in 50 per cent alcohol, to be used as drops, after which the ear is blotted dry.

The continued use of alcohol, salicylic acid, boric acid, acetone, sulfanilamide powder and other agents in various combinations has been recommended, but I think the current

opinion is that the ears are best left alone except for the simple hygienic measures already mentioned, on the ground that the more closely normal physiologic conditions are approximated, the less likely is a recurrence of infection.

SUMMARY.

The treatment of otitis externa should be a matter of principles rather than of the use of special agents. Once principles are established and understood, other therapeutic details fall into their proper relationship. The best results are secured by otologists who limit themselves to a few agents, select them because of their antibacterial or fungicidal effects, employ them for as brief a period as the necessities of the case permit, and supplement them by thorough cleansing of the external auditory canal and by measures for the relief of discomfort.

REFERENCES.

1. McBurney, Ralph, and Seabcy, Harvey B.: Otomycosis. An Investigation of Effective Fungicidal Agents in Treatment. *Ann. Otol., Rhinol. and Laryngol.*, 45:988-1008, Dec., 1936.

2. Gill, E. King: Evaluation of Newer Drugs in the Treatment of Otitis Externa. *Arch. Otolaryngol.*, 52:25-30, July, 1950.

3. Gill, E. King: Management of Otomycosis. *Air Surg. Bull.*, 2:402-403, Nov., 1945.

4. Gill, William D.: Otitis Externa. *Ann. Otol., Rhinol .and Laryngol.*, 51:370-377, June, 1942.

5. Gill, William D.: Otomycosis. Some Comments Concerning Its Incidence, Symptomatology and Treatment. *South. Med. Jour.*, 40:637-644, Aug., 1947.

6. Gill, William D.: Otomycosis. Some Remarks Concerning Its Prevalence, Symptomatology and Treatment. *Ann. Otol., Rhinol. and Laryngol.*, 47:189-195, Mar., 1938.

7. Gill, William D., and Gill, E. King: Otitis Externa. Some Comments Concerning the Present Status of Therapy. *South. Med. Jour.*, 43:428-431, May, 1950.

8. Senturia, Ben H.: Treatment of External Otitis. I.—Local Sulfonamide Therapy. The Laryngoscope, 54:277-286, June, 1944.

9. Senturia, Ben H.: Penicillin Therapy in External Otitis. *Ann. Otol., Rhinol. and Laryngol.*, 55:90-107, Mar., 1946.

10. Senturia, Ben H., and Broh-Kahn, Robert H.: The Use of Streptomycin in the Treatment of Diffuse External Otitis. *Ann. Otol., Rhinol. and Laryngol.*, 56:81-89, Mar., 1947.

11. SENTURIA, BEN H., and DOUBLY, JOHN A.: Treatment of External Otitis. III.—The Use of Vehicles and Antibiotics in the External Auditory Canal. In Vitro Studies. THE LARYNGOSCOPE, 57:633-656, Oct., 1947.

12. SENTURIA, BEN H., and WOLF, FRED T.: Treatment of External Otitis. II.—Action of Sulfonamide Compounds on Fungi Isolated from Cases of Otomycosis. *Arch. Otolaryngol.*, 41:56-63, Jan., 1945.

13. SENTURIA, BEN H.; MATTHEWS, JOHN I., and ADLER, BENARD C.: External Otitis. IV.—Cytologic Study of Secretions. THE LARYNGOSCOPE, 60:543-550, June, 1950.

14. SENTURIA, BEN H.: In discussion of Fowler.[15]

15. FOWLER, EDMUND P.: Topical Application to the Skin of the Ear Canal. *Trans. Am. Acad. Ophth. and Otolaryngol.*, 53:637-643, July-Aug., 1949.

16. FABRICANT, NOAH D., and PERLSTEIN, M. A.: pH of the Cutaneous Surface of the External Auditory Canal. A Study of 27 Infants, 44 Children and 60 Adults. *Arch. Otolaryngol.*, 49:201-209, Feb., 1949.

17. ZIMMERMAN, HENRY A.: A Preliminary Report of the Use of Sulfadiazine Bentonite Solution in the Treatment of External Otitis. *Mil. Surg.*, 08:426-427, May, 1946.

18. PHILPOTT, IVAN W., and CHESSEN, JAMES: Tropical Otitis. *Rocky Mt. Med. Jour.*, 42:345-347, May, 1945.

19. MCLAURIN, J. W.: The Local Application of "Sulfamylon" [Para-(Aminoethyl)-Benzene Sulfonamide Hydrochloride] in Otitis Externa and Chronic Otitis Media. A Preliminary Report of 141 Infections in 108 Patients. THE LARYNGOSCOPE, 58:1201-1205, Nov., 1948.

20. HILGER, J. A.: Personal communication.

21. REARDON, WILLIAM T.: Use of "Iso-Par" Ointment in the Treatment of Otitis Externa. *Arch. Otolaryngol.*, 45:294-297, Mar., 1947.

22. WALKER, JAMES S.: Therapeutic Evaluation of Iso-Par in Otitis Externa. *Bull. Johns Hopkins Hosp.*, 83:225-228, Sept., 1948.

23. HAYES, MERRILL B., and HALL, C. FREMONT: The Management of Otogenic Infection. *Trans. Am. Acad. Ophth. and Otolaryngol.*, pp. 149-163, Jan.-Feb., 1947.

24. SULLIVAN, JOSEFH A., and SMITH, J. BRYDON: The Office Treatment of Chronic Otitis. *Ann. Otol., Rhinol. and Laryngol.*, 69:364-380, June, 1950.

25. OCHS, IRVING L.: Treatment of External Otitis; a Simple and Effective Technique. *Jour. A. M. A.*, 142:1361-1362, Apr. 29, 1950.

26. NELSON, ROY F.: External Otitis in the South Pacific. *Ann. Otol., Rhinol. and Laryngol.*, 54:367-372, June, 1945.

A NEW INSTRUMENT FOR USE IN MAKING ANTRUM WINDOWS.*

MORRIS DAVIDSON, M.D.,
St. Louis, Mo.

Otolaryngologists who have made antrum windows are aware of the many difficulties that accompany such procedures. Several different instruments must be used and frequently these instruments do not possess the necessary angle or curve to permit satisfactory removal of the bony tissues in the lateral nasal wall.

An antrum window perforator and enlarging cutter of one piece has been devised which eliminates the necessity for varied perforating, rasping and biting instruments. This instrument has a chain drive and can be quickly attached to any standard dental handpiece. The dental engine should be operated at the lowest speed. The angle of the tip is approximately 45 degrees. Employing the dental engine and handpiece which are now available in most operating rooms, the entire procedure of making antrum windows can be accomplished with this single instrument.

The first portion of the instrument is a perforator burr for use in entering the maxillary antrum through the inferior meatus. The portion behind the perforator is a concave cutter. When the perforation has been accomplished the instrument is moved in circular manner and the concave cutter portion is used to enlarge the window to the desired size. In a matter of a few seconds a large antrum window can be made with smooth edges, the margins of which can be extended in any direction with ease.

*From the Department of Otolaryngology, Washington University Medical School, St. Louis, Mo.

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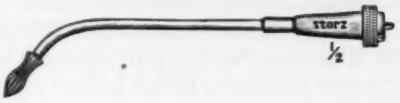
This instrument has also been used to enter and enlarge the opening through the canine fossa during the Caldwell-Luc operation.



Because of the possibility of explosion, this instrument has not been used in those cases operated under general anesthesia in which one of the explosive anesthetics has been used.

KENFIELD MEMORIAL SCHOLARSHIP.

In 1937 a sum of money was subscribed in memory of Miss Coralie N. Kenfield, of San Francisco, Calif., a teacher of advanced methods in teaching lipreading. This money, placed in the Kenfield Memorial Fund, is administered by the American Hearing Society and provides an annual scholarship. The amount of the Kenfield Memorial Scholarship for 1951 is $100.00.

Applications for the scholarship will be considered from any resident of the United States who desires to teach lipreading (speechreading) with or without other types of hearing and speech therapy, and who can meet the following requirements:

A. Personal. Well adjusted individual with a pleasing personality, legible lips, a good speech pattern and no unpleasant mannerisms. *B. Education.* College graduate with a major in education, psychology, and/or speech. If the applicant is hard of hearing, 30 clock hours of private instruction under an approved teacher of lipreading or 60 clock hours of instruction in public school classes under an approved teacher of lipreading are required.

The winner of the scholarship may take the Teacher Training Course from any normal training teacher or school or university in the United States offering a course acceptable to the Teachers' Committee of the American Hearing Society. The scholarship must be used within one year from the date the award is made.

Applicants must be prospective teachers of lipreading to the hard of hearing. Those already teaching lipreading cannot be considered.

Applications must be filed between March 1 and May 1, 1951, with: Miss Rose V. Feilbach, Chairman, Teachers' Committee, 1157 North Columbus Street, Arlington, Va.

January 1, 1951.

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION.

As of April 1, 1950.

Aurex Model F and Model H.
Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago, Ill.

Beltone Mono-Pac; Beltone Harmony Mono-Pac; Beltone Symphonette; Beltone Mono-Pac Model M.
Manufacturer: Beltone Hearing Aid Co., 1450 W. 19th St., Chicago, Ill.

Cleartone Model 500; Cleartone Regency Model.
Manufacturer: American Sound Products, Inc., 2454 S. Michigan Ave., Chicago 16, Ill.

Dysonic Model 1.
Manufacturer: Dynamic Hearing Aids, 43 Exchange Pl., New York 5, N. Y.

Electroear Model C.
Manufacturer: American Earphone Co., Inc., 10 East 43rd St., New York 17, N. Y.

Gem Hearing Aid Model V-35; Gem Model V-60.
Manufacturer: Gem Ear Phone Co., Inc., 50 W. 29th St., New York 1, N. Y.

Maico Atomeer; Maico UE-Atomeer; Maico Quiet Ear Models G and H.
Manufacturer: Maico Co., Inc., North Third St., Minneapolis, Minn.

Mears Aurophone Model 200; 1947—Mears Aurophone Model 98.
Manufacturer: Mears Radio Hearing Device Corp., 1 W. 34th St., New York, N. Y.

Micronic Model 101 (Magnetic Receiver); Micronic Model 303. (See Silver Micronic.)
Manufacturer: Micronic Co., 727 Atlantic Ave., Boston 11, Mass.

Microtone T-3 Audiomatic; Microtone T-4 Audiomatic; Microtone T-5 Audiomatic; Microtone Classic Model T9; Microtone Model 45.

Manufacturer: Microtone Co., 4602 Nicollet Ave., Minneapolis 9, Minn.

National Cub Model C; National Standard Model T; National Star Model S; National Ultrathin Model 504; National Vanity Model 506.

Manufacturer: National Hearing Aid Laboratories, 815 S. Hill St., Los Angeles 14, Calif.

Otarion Model E-1; Otarion Model E-1S; Otarion Model E-2; tarion Model E-4; Otarion Models F-1 and F-2.

Manufacturer: Otarion Hearing Aids, 159 N. Dearborn St., Chicago, Ill.

Paravox Models VH and VL (Standard); Paravox Model XT (Xtra-Thin); Paravox Model XTS (Xtra-Thin); Paravox Model Y (YM, YC and YC-7) (Veri-Small).

Manufacturer: Paravox, Inc., 2056 E. 4th St., Cleveland, Ohio.

Radioear Permo-Magnetic Multipower; Radioear Permo-Magnetic Uniphone; Radio Ear All Magnetic Model 55; Radioear Model 62 Starlet.

Manufacturer: E. A. Myers & Sons, 306 Beverly Rd., Mt. Lebanon, Pittsburgh, Pa.

Silver Micronic; Silver Micronic (Magnetic and Crystal) Models 202M and 202C. (See Micronic.)

Manufacturer: Micronic Corp., 101 Tremont St., Boston 8, Mass.
(See Micronic.)

Silvertone Model 103BM.

Manufacturer: National Hearing Aid Laboratories, 815 S. Hill St., Los Angeles 14, Calif.
Distributor: Sears-Roebuck & Co., 925 S. Homan Ave., Chicago 7, Ill.

Silvertone Model M-35.

Manufacturer: Microme Co., 727 Atlantic Ave., Boston 11, Mass.
Distributor: Sears-Roebuck & Co., 925 S. Homan Ave., Chicago 7, Ill.

Silvertone Model P-15.

Manufacturer: W. E. Johnston Mfg. Co., 708W. 40th St., Minneapolis, Minn.
Distributor: Sears-Roebuck & Co., 925 S. Homan Ave., Chicago 7, Ill.

Solo-Pak Model 99.

Manufacturer: Solo-Pak Electronics Corp., Linden St., Reading, Mass.

Sonotone Model 600; Sonotone Model 700; Sonotone Model 900; Sonotone Models 910 and 920; Sonotone Model 925.

Manufacturer: Sonotone Corp., Elmsford, N. Y.

Superfonic Hearing Aid.

Manufacturer: American Sound Products, Inc., 2454 S. Michigan Ave., Chicago, Ill.

Televox Model E.

Manufacturer: Televox Mfg. Co., 117 S. Broad St., Philadelphia 7, Pa.

Telex Model 22; Telex Model 97; Telex Model 99; Telex Model 200; Telex Model 1700.

Manufacturer: Telex, Inc., Minneapolis 1, Minn.

Tonemaster Model Royal.

Manufacturer: Tonemasters, Inc., 400 S. Washington St., Peoria 2, Ill.

Trimm Vacuum Tube No. 300.

Manufacturer: Trimm, Inc., 400 W. Lake St., Libertyville, Ill.

Unex Model "A"; Unex Midget Model 95; Unex Midget Model 110.

Manufacturer: Nichols & Clark, Hathorne, Mass.

Vacolite Model J.

Manufacturer: Vacolite Co., 3003 N. Henderson St., Dallas 6, Tex.

Western Electric Model 63; Western Electric Model 64; Western Electric Models 65 and 66.

Manufacturer: Western Electric Co., Inc., 120 Broadway, New York 5, N. Y.

Zenith Model 75; Zenith Miniature 75.

Manufacturer: Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill.

All of the accepted hearing devices employ vacuum tubes.

Accepted Hearing Aids more than five years old have been omitted from this list for brevity.

TABLE HEARING AIDS.

Aurex (Semi-Portable)—*Jour. A. M. A.*, 109:585 (Aug. 21), 1937.

Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago (10), Ill.

Precision Table Hearing Aid—*Jour. A. M. A.*, 139:785-786 (Mar. 19), 1949.

Manufacturer: Precision Electronics Co., 850 West Oakdale Ave., Chicago 14, Ill.

Sonotone Professional Table Set Model 50—*Jour. A. M. A.*, 141:658 (Nov. 15), 1949.

Manufacturer: Sonotone Corp., Elmsford, N. Y.

All of the Accepted hearing devices employ vacuum tubes.

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